

Office of Environmental Health & Safety

Chemical/Biological Safety Section

Chemical Hygiene Plan (CHP)

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FORWARD

Virginia Commonwealth University/Medical College of Virginia/Medical College of Virginia Hospitals is committed to providing a safe working environment and believes employees have a right to know about health hazards associated with their work. So that employees can make knowledgeable decisions about any personal risks of employment, this Chemical Hygiene Plan includes policies, procedures, and responsibilities designed to develop in employees an awareness of potentially hazardous chemicals in the workplace and to train employees in appropriate, safe working conditions.

It is important that employers assume responsibility for laboratory safety. All employees will have access to pertinent safety information through their supervisory staff. The people who work in any given laboratory are best able to detect potential hazards in either the facility or in work procedures. When safety concerns arise, employees are encouraged to contact their supervisor. If additional assistance is needed, contact the Office of Environmental Health & Safety (OEHS), Chemical/Biological Safety Section at 828-1392.

The primary responsibility for training is with the supervisor. Additional training regarding laboratory safety is available as follows:

- Microbiology 512 - This one credit course is a comprehensive review of laboratory safety procedures and practices. It is offered in both Fall and Spring semesters with sufficient interest. **This course is highly recommended for all laboratory employees.**
- OEHS - One to two hour laboratory safety lectures are offered periodically. Lectures are offered on request by calling 828-1392.

The following training materials are offered:

- Videotape - A 35 minute series of videotapes produced by the Howard Hughes Medical Institute can be borrowed from OEHS. These videotapes are an excellent review of chemical hygiene procedures in the laboratory.
- Reference Materials - *Prudent Practices for Handling Hazardous Chemicals in Laboratories*, from Academic Press, may be ordered from the MCV Bookstore.

This reference was used to develop the Occupational Safety and Health Administration's - Laboratory Safety Standard. It is a highly recommended reference for chemical hygiene officers (CHO's).

Additional information will be made available to inform the employee how best to handle hazardous chemicals and how to make use of the new law and regulations.

STANDARD OPERATING PROCEDURES (SOPs)

Because few laboratory chemicals are without hazards, general precautions for handling all laboratory chemicals should be adopted to include minimizing exposure and assuming that any mixture of hazardous chemicals is more toxic than the most toxic component.

The following procedures are used when working with chemicals:

1. *Accidents and spills*

- a. Eye contact: promptly flush eyes with water for a prolonged period (15 minutes) and seek medical attention.
- b. Ingestion: seek immediate medical attention at Employee Health (828-0584) or the MCVH Emergency Room.
- c. 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.
- d. Clean-up: promptly clean up spills, using appropriate protective apparel and equipment and proper disposal. Contact the OEHS Emergency line at 828-9834 for assistance.
- e. Record incidents involving hazardous substances in a spill log. Injuries must be reported to Human Resources Services; property damage must be reported to the Office of Risk Management.

2. *Avoid unnecessary exposure to chemicals.*

- a. Do not smell or taste chemicals. Apparatus that can discharge toxic chemicals (vacuum pumps, distillation columns, etc.) should be vented into local exhaust devices.
- b. Inspect gloves for holes or tears and test glove boxes before use.

- c. Do not allow release of toxic substances in cold rooms and warm rooms, since these have contained recirculated atmospheres.
- d. Use only those chemicals for which the quality of the available ventilation system is appropriate.
- e. Avoid eating, drinking, smoking, gum chewing, or applying cosmetics or lip balm in areas where laboratory chemicals are present. Wash hands before conducting these activities.
- f. Do not store, handle, or consume food or beverages in storage areas, refrigerators, glassware, or utensils that are also used for laboratory operation.
- g. 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.
- h. Wash areas of exposed skin thoroughly before leaving the laboratory.
- i. Avoid practical jokes or other behavior that might confuse, startle, or distract another worker.
- j. Do not use mouth suction for pipetting or starting a siphon.
- k. Confine long hair and loose clothing.
- l. Wear shoes at all times in the laboratory, but do not wear sandals, perforated shoes or "birkenstocks".
- m. Keep the work area clean and uncluttered, with chemicals and equipment properly labeled and stored; clean up the work area on completion of an operation and at the end of each day.
- n. Ensure that appropriate eye protection, where necessary, is worn by all persons, including visitors, in areas where chemicals are stored or handled.
- o. Wear appropriate gloves when the potential for contact with toxic materials exists; inspect the gloves before each use, wash them before removal, and replace them periodically.
- p. Use appropriate respiratory equipment when air contaminant concentrations are not sufficiently restricted by engineering controls. Inspect the respirator before each use. All respirator usage must be approved by OEHS (828-1392).

- q. Use any other protective and emergency apparel and equipment as appropriate.
- r. Avoid use of contact lenses in the laboratory unless necessary; if they are used, inform supervisor so special precautions can be taken.
- s. Remove laboratory coats immediately upon significant contamination.
- t. Seek information and advice about hazards, plan appropriate protective procedures, and plan positioning of equipment before beginning any new operation.
- u. Leave lights on, place an appropriate sign on the door, and provide for containment of toxic substances in the event of failure of a utility service (such as cooling water) in an unattended operation.
- v. Use a hood for operations that might result in release of toxic chemical vapors or dust.
- w. As a rule of thumb, use a hood or other local ventilation device when working with any volatile substance considered hazardous or toxic.
- x. 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.
- y. 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."
- z. Be aware of unsafe conditions and see that they are corrected when detected.

CHEMICAL INVENTORY

A chemical inventory is performed annually, listing all the hazardous chemicals in the laboratory. Chemicals listed are those classified as hazardous by the Department of Transportation (DOT), the Environmental Protection Agency (EPA), or displaying a 2 or greater number in any section of the National Fire Protection Association (NFPA) diamond. DOT and EPA classifications are in [Appendices A](#) and [B](#).

Chemicals are listed alphabetically by section according to the most commonly used name (e.g., bleach). A catalog number may be required by some manufacturers for MSDSs. The average quantity in storage on a monthly basis, as well as the physical state (e.g., solid, liquid, gas), is included. The NFPA hazard classification, if known, is listed along with the manufacturer's name and complete address. A comment section is provided to further identify the chemical's location (e.g., under the sink, third shelf in the safety cabinet, etc.) A complete chemical inventory is to be inserted as [Appendix C](#).

Inventories are computerized whenever possible to provide the capability of sorting according to manufacturer or location. A complete chemical inventory is located in the office of the Chemical Hygiene Officer.

MATERIAL SAFETY DATA SHEETS (MSDSs)

Upon completion of the chemical inventory, material safety data sheets (MSDSs) are gathered for each chemical. MSDSs should reside in the office of the CHO. MSDSs can also be found by visiting the OEHS Chemical/Biological Safety Section website and searching under the MSDS section heading. In either circumstance, all VCU/MCVH employees must be furnished with an MSDS during the same work shift it was requested.

CHEMICAL STORAGE

Storage of laboratory chemicals presents an ongoing safety problem. Some storage charts assume an unlimited amount of cabinets. At VCU and MCVH laboratory space is sometimes limited; therefore an acceptable storage plan is essential to the safety of the laboratory. REMEMBER: alphabetic storage is prohibited. [Appendix G](#) provides some general guidelines on chemical segregation and storage.

The chemical inventory should be kept as small as possible. Storage on bench tops and in hoods may cause potential exposure to fire and spills. Ventilated cabinets and specially monitored refrigerators are used for chemical storage only. No food is permitted in these refrigerators. Flammable liquids are stored in flammable storage cabinets with self-closing doors and proper ventilation according to NFPA standards. Safety cans with a spring-loaded spout are used for transporting flammable liquids.

Toxic chemicals, including carcinogens, are stored in ventilated storage areas in unbreakable chemical-resistant secondary containers. These containers are labeled "CAUTION: HIGH CHRONIC TOXICITY OR CANCER SUSPECT AGENT." A separate inventory list of carcinogens and suspected carcinogens is maintained by the CHO according to federal and state regulations. In addition, a safe storage plan is available with this CHP.

Cylinders of compressed gases are strapped or chained to a wall or bench top and are capped when not in use. [Appendix D](#) contains safe handling practices and procedures for gas cylinders.

LABELING

The 29 CFR 1910.1450 contains specific labeling requirements. Labeling must be done on all hazardous chemicals that are shipped and used in the workplace. Labels must not be removed or defaced.

Chemical manufacturers, importers, and distributors make sure that each container of hazardous chemicals leaving the workplace is labeled, tagged, or marked with the following information:

1. Identity of the hazardous chemical
2. Appropriate hazard warnings
3. Name and address of the chemical company (i.e., manufacturer).

Each hazardous chemical transferred outside the laboratory that is not in its original container must also be labeled. These workplace labels must contain:

1. Identity of the hazardous chemical
2. Route of entry (e.g., eyes, nose, mouth, skin)
3. Health hazard
4. Physical hazard
5. Target organ affected.

ENGINEERING CONTROLS

1. All biohazard and fume hoods are inspected annually and certified by _____ (telephone _____). Any hood not passing inspection is taken out of service immediately and not used until the hood has passed inspection. It is the responsibility of the employer, through the efforts of VCU's Physical Plant, to purchase the parts and to replace the unit in a timely fashion so as not to endanger the health and well-being of an employee or place the facility at risk.

2. Eyewash fountains are inspected annually and records kept by the OEHS Fire Safety Section (telephone 828-7899). (Portable eyewash stations are the responsibility of the laboratory manager).
3. Safety showers are inspected, tested, and flushed annually and records maintained by the OEHS Fire Safety Section (telephone 828-7899).
4. Fire extinguishers are inspected at least quarterly by the OEHS Fire Safety Section (telephone 828-7899).
5. All chemical stockrooms/storerooms are adequate and well ventilated and located in room(s) _____.
6. Ventilated storage cabinets for chemicals are provided as needed and have a separate exhaust duct. These cabinets are located in room(s) _____.
7. Exhaust air from glove boxes and isolation rooms is passed through scrubbers before being released into the regular exhaust system.
8. Cold rooms and warm rooms have provisions for rapid escape and also for escape in the event of electrical failure.
9. Air flow through the laboratory should be relatively uniform and be exhausted to the exterior of the building. Quality and quantity of ventilation are monitored as needed and records maintained by the CHO.
10. All chemical hygiene related equipment is monitored continuously and modified if inadequate.

PERSONAL PROTECTIVE EQUIPMENT

1. Employees are required to wear gloves when the employee has the potential for direct skin contact with blood, hazardous chemicals, and infectious materials.
2. Lab coats are to be worn only in the laboratory area and are to be buttoned to protect the employee's clothing. Lab coats are provided by the laboratory manager.
3. In areas where chemical splashes are great an impervious apron appropriate for the task is worn.
4. Masks and eye protection or chin-length face shields are worn to prevent splashes or sprays of blood, infectious materials, or hazardous chemicals if there is a potential for eye, nose, or mouth contamination. This equipment is located at _____.

5. Where the use of respirators is necessary to maintain exposure below permissible exposure limits, the laboratory manager provides, at no cost to the employee, the proper respiratory equipment located at _____. The respirators shall be selected and used in accordance with the requirements of 29 CFR 1910.134 (OSHA's Respiratory Protection Standard). Contact OEHS for selection of appropriate respiratory protection equipment.

CHEMICAL WASTE DISPOSAL

The University/Hospital Chemical Waste Disposal Program, ([located on the OEHS webpage](#)), specifies how waste is to be collected, segregated, stored, and transported and includes consideration of what materials can be incinerated. All disposal is done in accordance with EPA/Virginia Department of Waste Management regulations.

Hazardous chemical wastes are accepted for disposal by OEHS on an appointment-only basis each Tuesday and Thursday from 9:00 a.m. to 9:30 a.m. at the Sanger Hall loading dock. Wastes are accepted in properly sealed and labeled disposable bottles or containers, accompanied by a signed Hazardous Waste Disposal Form. A reproducible copy of this form is found in [Appendix E](#) and on the [OEHS](#) webpage.

Certain laboratory-generated wastes such as needles, broken glass and infectious waste (see Infectious Waste Disposal Section) are not accepted on this basis.

Non-infectious needles, broken glass, and other sharps should be enclosed in appropriate sharps containers and disposed of along with other routine solid waste. Sharps containers can be obtained from Central Supply.

Incineration in an environmentally acceptable manner is the most practical disposal method for combustible laboratory waste. Indiscriminate disposal by pouring waste chemicals down the drain or adding them to mixed refuse for landfill burial is unacceptable. Hoods are not to be used as a means of disposal for volatile chemicals. Disposal by recycling or chemical decontamination is used when possible.

Questions regarding VCU's Hazardous Chemical Disposal Program should be directed to OEHS, Attn: Chemical Waste Technician (828-1392).

INFECTIOUS WASTE DISPOSAL

Infectious wastes are managed in accordance with the Virginia Department of Waste Management's Infectious Waste Management Regulations. Laboratories generating regular amounts of infectious waste must set up a contract for periodic removal (828-9444). Autoclave waste must be packaged in orange biohazard bags, autoclaved under the mandated pressures and time, and placarded with a label of ownership. It is the responsibility of the principle investigator or the laboratory manager to familiarize themselves with the latest information and requirements. Further

information regarding disposal infectious waste can be obtained from [Bloodborne Pathogens –Infectious Waste Management](#) webpage.

ADMINISTRATIVE CONTROLS

The Laboratory Manager is responsible for the safe operation of the area. All activities and procedures require the Laboratory Manager's approval. Environmental monitoring is required in all laboratories for the following chemicals as required by applicable regulatory agencies:

asbestos	tremolite
anthophyllite	actinolite
coal tar pitch volatiles	4-nitrobiphenyl
alpha-naphthylamine	methyl chloromethyl ether
3,3'-dichlorobenzidine	bis-chloromethyl ether
beta-naphthylamine	benzidine
4-aminodiphenyl	ethyleneimine
beta-propiolactone	2-acetylaminofluorene
4-dimethylaminoazobenzene	N-nitrosodimethylamine
vinyl chloride	inorganic arsenic
lead	benzene
coke oven emissions	cotton dust
1,2-dibromo-3-chloropropane	acrylonitrile
ethylene oxide	formaldehyde
nitrous oxide	glutaraldehyde

Laboratories utilizing any of the above chemicals should contact OEHS for appropriate environmental monitoring if it is not currently being conducted.

Chemical spills are contained using the Think C.L.E.A.N. Plan:

Contain the spill

Leave the area

Emergency: eye wash, shower, medical care

Access MSDS

Notify a supervisor.

All laboratories utilizing hazardous chemicals must have appropriate spill kits, located at _____. Spills of hazardous substances are recorded in this Chemical Hygiene Plan. Personal injuries are reported to Human Resources Services; and the Office of Risk Management is notified of any property damage. Assessment of significant risk of all operations is made by the Laboratory Manager or CHO. Chemical hygiene and safety policies will be established for each task performed and engineering controls or personal protective equipment assigned. An attached list, submitted by the CHO, identifies each work-station/task in the laboratory and the required controls and equipment.

[Appendix F](#) lists the important telephone numbers for the laboratory.

MEDICAL CONSULTATIONS

All employees needing medical attention use the employee health services at 828-0585. All required medical examinations and consultations are performed by or under the direct supervision of a licensed physician without cost to the employee, without loss of pay, and at a reasonable time and place.

The employee is sent for medical evaluation:

1. Whenever signs and symptoms associated with a hazardous chemical develop.
2. When environmental monitoring reveals an exposure level routinely above the action level.
3. Whenever an event takes place in the work area such as a spill, leak, or explosion resulting in hazardous chemical exposure. The laboratory provides the following information to the physician:
 - a. Identity of the hazardous chemical(s) to which the employee may have been

exposed

- b. A description of the conditions under which the exposure occurred--including quantitative exposure data (if available)
- c. A description of the signs and symptoms of exposure
- d. A copy of the MSDS for the chemical(s) involved.

The physician provides a written opinion that will not reveal specific finding of diagnosis unrelated to the exposure but will include:

1. Any recommendation for further medical follow-up
2. Results of the medical examination and any associated tests
3. Any medical conditions that may be revealed in the course of the examination that may place the employee at increased risk as a result of exposure to a hazardous chemical found in the workplace
4. A statement by the physician that the employee has been informed of the consultation/examination results and any medical condition that may require further examination or treatment.

CHEMICAL HYGIENE OFFICER/COMMITTEE

The chemical hygiene responsibilities rest with the Chemical Hygiene Officer who is appointed by the Laboratory Manager and receives backing from the Department Director or Principal Investigator. The Chemical Hygiene Officer must:

1. Work with administrators and other employees to develop and implement appropriate chemical hygiene policies and practices.
2. Support the use of protective equipment when required.
3. Monitor procurement, use, and disposal of chemicals used in the lab.
4. Know the current legal requirements concerning regulated substances.
5. Ensure that the chemical inventory list is conducted and updated as needed.
6. Seek ways to improve the chemical hygiene program.

The immediate supervisor has overall responsibility to:

1. Ensure that workers know and follow the chemical hygiene rules, that protective equipment is available and in working order, and that appropriate training has been provided.
2. Provide regular, formal chemical hygiene and housekeeping inspections including routine inspections of emergency equipment.
3. Know the current legal requirements concerning regulated substances.
4. Determine the required levels of protective apparel and equipment.
5. Ensure that facilities and training for use of any material being ordered are adequate.

The laboratory employee is responsible for:

1. Planning and conducting each operation in accordance with the institutional chemical hygiene procedures
2. Developing good personal chemical hygiene habits.

At least one member from each laboratory section will be appointed to serve on the Laboratory Safety Committee, which will meet no less than four times a year to discuss safety and chemical hygiene issues.

TRAINING

Training is a necessary and important part of the Chemical Hygiene Plan. All employees must attend *Safety Awareness* orientation at the time of the employee's initial assignment to a work area where hazardous chemicals are present and before assignments involving new exposure situations. Refresher information and retraining sessions are held periodically. Training is conducted by the employee's immediate supervisor who was appropriately trained. All training is documented in writing by attendance records.

Before training can begin, a lesson plan outlines the expectations of the program and the time frame for the learning outcome. The lesson plan includes:

I. OBJECTIVES

Upon completion of the Chemical Hygiene Training Program, the employee will be able to:

- A. Locate the potentially hazardous chemicals in the workplace
- B. Recognize the chemical labeling and its meaning
- C. Locate the MSDS book in the workplace
- D. Locate the health hazard, physical hazard, environmental protection, and special protection sections of the MSDS and explain their use
- E. Identify the department Chemical Hygiene Officer by name and title
- F. Discuss the major components of the laboratory's labeling system
- G. Identify the appropriate protective clothing for the area and demonstrate its use
- H. Demonstrate emergency procedures in the event of a hazardous chemical spill
- I. Describe the environmental monitoring protocol

II. ACTIVITY PLAN

- A. A list of audiovisuals used and directions
 - 1. Videotape or slide/tape
 - 2. Equipment instructions
 - 3. Handouts

- i. obtaining a copy

- c. labeling information

- i. hazard warnings

- ii. carcinogen warnings

- iii. location in workplace

4. Procedures for handling hazardous chemicals

- a. work practices

- b. proper moving, storing, and use

- c. PEL for specific chemicals used by the employee

- d. visual appearance of chemicals used by the employee

- e. environmental monitoring required

- f. signs and symptoms of exposure

- g. protective equipment used to prevent overexposure

- h. conditions to avoid

5. Environmental protection

- a. emergency procedures

- b. spill containment

- c. medical consultation procedures

6. Documentation of initial and annual training

III. Summary

- A. Restate the objectives

- B. Restate the main points

- C. Answer any questions to clear up misunderstandings.

HOUSEKEEPING

Floors are cleaned regularly by housekeeping. All employees of the housekeeping department are formally trained in the risks associated with working in the laboratory.

The housekeeping supervisors conduct periodic inspections of the lab areas to assess whether:

1. Stairwells and hallways are free of obstruction
2. Waste is deposited in appropriate receptacles and properly removed from the laboratory
3. Chemical spills are cleaned according to established protocol
4. Proper storage is accomplished to minimize clutter

RECORD KEEPING

1. The laboratory has established and maintained an accurate record for each employee of environmental monitoring, medical consultations, and examinations, including tests or written opinion required. A spill log of incidents involving hazardous substances is also maintained.

2. Accident records are initiated by the employee and supervisor and retained by Human Resources Services (HRS) (telephone 8-1533). Property damage is reported to the Office of Risk Management (University: 8-6533; Hospital: 6-1707).

3. Environmental monitoring records are maintained by OEHS, Chemical/Biological Safety Section (telephone 828-4866). Results must be made available to all employees who work in the area(s) monitored.

4. Medical consultation records are maintained by Employee Health Services (EHS) (telephone 828-0585).

5. Training attendance records are maintained by the CHO.

6. All records are kept, transferred, and made available in accordance with 29 CFR 1910.20.

REFERENCES

The following references were used to assist in the preparation of this document:

1. U.S. Department of Labor, final rule part II. Federal Register 29 CFR Part 1910.

Occupational Exposure to Hazardous Chemicals in Laboratories, Wednesday, January 31,1990. Copies of this document may be obtained from OEHS.

2. National Research Council. Prudent Practices for Handling Hazardous Chemicals in Laboratories, National Academy Press, 1995. Copies of this document may be ordered from the MCV Bookstore.
3. National Research Council. Prudent Practices for Disposal of Chemicals from Laboratories, National Academy Press, 1981.

APPENDICES

- A. [DOT Hazard Classification List](#)
- B. [EPA Hazard Classification List](#)
- C. [Chemical Inventory](#)
- D. [Compressed Gas Information Sheet](#)
- E. [Hazardous Waste Disposal Form](#)
- F. [Important Telephone Numbers For The Laboratory](#)
- G. [Chemical Segregation Guidelines](#)
- H. [Glossary](#)

APPENDIX A *DOT HAZARD CLASSIFICATION LIST*

<u>Hazard Classifications</u>	<u>Example</u>
Explosive A & B	Dynamite
Explosive C	Fireworks
Blasting agents	Plastic explosives
Radioactive material	CO-60 or I-130
Flammable liquids	Alcohol
Pyrophoric liquids	Phosphorus hydrids
Non-flammable compressed gases	Nitrogen
Flammable gases	Oxygen
Combustible liquids	Kerosene
Flammable solids	Picric acid/10% wet
Oxidizer	Nitric acid
Corrosive material	Hydrochloric acid

Irritating material
Poison A
Poison B
Organic peroxide
ORM⁽¹⁾-A
ORM-B
ORM-C
ORM-D
ORM-E
Etiological agents

Lacramator
Heptachlor
Phenol
Benzoyl peroxide
Formaldehyde
Mercury
Asbestos
Bleach
Ferric sulfate
Microorganisms (E. coli)

1 ORM = Other Regulated Material

APPENDIX B <i>EPA HAZARD CLASSIFICATION LIST</i>

1. *IGNITABLE WASTE* - Flash point < 140⁰ F
Flammable solids
Oxidizers
Flammable gases
Some combustible liquids
Pyrophoric liquids
2. *CORROSIVES* - Any liquid of pH 2 or 12.5
3. *REACTIVE* - Explosives A, B, or C
Water reactive
Cyanide or sulfide
Organic peroxides
Poison B
4. *TOXIC (by EXTRACTION PROCEDURE (EP) TOXIC)* -
8 Metals:

Arsenic Silver
Cadmium Lead
Chromium Beryllium
Mercury Thallium
4 Pesticides:
Lindane Toxaphene
Endrin Methoxychlor
2 Herbicides:
2,4 D 2,4,5 T
Poison A and some poison B
Irritating material
Radioactive material
ORM-A-B-C
ORM-E

APPENDIX C <i>CHEMICAL INVENTORY</i>

Please insert your current chemical inventory sheet here.

A list of substances considered hazardous (by OSHA) is available in room B2-001, Sanger Hall, (telephone 828-4866).

APPENDIX D <i>COMPRESSED GAS INFORMATION SHEET</i>

Because some compressed gases are flammable and all are under pressure, they must be handled with extreme care. An exploding cylinder can have the **same destructive effect as a bomb**. Compressed gases used in universities and hospitals typically include *acetylene, ammonia, anesthetic gases, argon, chlorine, ethylene oxide, helium, hydrogen, methyl chloride, nitrogen, carbon dioxide, freon, and sulfur dioxide*.

Acetylene, ethylene oxide, methyl chloride, and hydrogen are flammable, as are the anesthetic agents *cyclopropane, diethyl ether, ethyl chloride, and ethylene*. Although *oxygen* and *nitrous oxide* are labeled as nonflammable, they are oxidizing gases that will aid combustion.

The proper handling of compressed gas cylinders requires training and a well-enforced safety program. Storage areas for compressed gas cylinders should be well ventilated, fireproof, and dry. Compressed gas cylinders should never be subjected to temperatures higher than 125°F. Cylinders should not be stored near steam pipes, hot water pipes, boilers, highly flammable solvents, combustible wastes, unprotected electrical connections, open flames, or other potential sources of heat or ignition. Cylinders should be properly labeled. The valve protection cap should not be removed until the cylinder is secured and ready for use. The cap should be replaced when the tank is empty.

The following are general precautions to take for storing and handling compressed gas cylinders:

1. Secure and segregate all cylinders. (Only purchase compressed gas cylinders from vendors with a return policy.)
2. Smoking should not be permitted in any area where gases are being used or stored.
3. Never drop cylinders or allow them to strike each other.
4. If cylinders are temporarily stored outside in the summer (i.e. in vehicles or on loading docks), make sure they are shaded from the rays of the sun.
5. Do not drag, roll, or slide cylinders. Use a hand truck and secure cylinders before moving.
6. Ensure that the regulator threads and cylinder threads match.
7. Do not store empty cylinders with full ones.
8. Do not allow a flame to come into contact with any part of a compressed gas cylinder.
9. Do not place cylinders where they may come in contact with electricity.
10. Never store flammable gases with nonflammable gases.

Additional information on compressed gases can be found in 29 CFR 1910.101-105; 49 CFR, Parts 171-179; and the *National Fire Codes* (NFPA 1983, Volume 4).

<p>APPENDIX E <i>CHEMICAL WASTE DISPOSAL FORM</i></p>

Investigator:

_____ Department: _____

Building: _____ Room: _____ Phone:

University/Hospital (circle one)

Type of Chemical Waste Identification and % Composition	Qty/Vol	For Office Use Only		
		Reference Number	Classification	Disposal Date
Example: 10% Silver Nitrate in 90% Water	2/4 Liters	.	.	.
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Comments :

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Signature _____ Date _____ Appointment Time and
Date _____

Generator: _____ Date: _____

_____ Principal Investigator/Post-Doctoral Fellow

APPENDIX F
EMERGENCY TELEPHONE NUMBERS

VCU Police		8-1234
Fire/Dr. Red	West Campus	8-1234 or *54
	East Campus	8-1234 or *54
Ambulance		9-911
Cardiac Emergencies	Code Blue	*52
	Code 99 (child)	*52
Poison Control Center		8-9123
Chemical Spills		8-9834
Radiation Emergencies		8-9834
Bomb Threats	Dr. Black	8-1234
Utility Failure	Dr. Current	8-9364
Loss of Medical Gas	Dr. Gas	8-9364
Flood	Dr. Wet	8-9364
Telepage		*60

APPENDIX G
Chemical Storage Guidelines

Always consult the Material Safety Data Sheet (MSDS) for specific chemical storage information. The following is a general guide for chemical storage as found at: www.ehs.ufl.edu/Lab/LabSafe.pdf

Store materials in each category separately:

1. Separate **liquids** from **solids** - Phenol crystals should be stored separately from oxidizers
2. Separate the liquid and solid sections into classes
 - a. **Acids**
 - i. Organic or Inorganic
 - ii. Store these chemicals separate from all others: Perchloric and Nitric acid
 - b. **Bases**
 - c. **Oxidizers:** Keep away from acids, bases, organics, reducing agents and metals
 - d. **Flammables**
 - i. Organic or inorganic
 - ii. Excess of 10 gallons should be stored in safety cabinets
 - e. **Non-Flammables:** Organic or inorganic
 - f. **Toxins**
 - g. **Reactives:** Water reactive, temperature sensitive, etc.

APPENDIX H

Glossary

The following terms are used as part of the Chemical Hygiene Plan (CHP). A more complete glossary is available from OEHS, room B2-001, Sanger Hall (telephone 828-4866).

ACUTE - An adverse effect with symptoms of high severity coming quickly to a crisis.

CARCINOGEN - A substance capable of causing cancer.

CFR - Code of Federal Regulations.

CHEMICAL AGENTS - A wide variety of fluids that have a high potential for body entry by various means. Some are more toxic than others and require special measures of control for safety and environmental reasons.

CHO - Chemical Hygiene Officer, the individual responsible for maintaining the chemical hygiene plan for a particular laboratory.

CHP - Chemical Hygiene Plan

CHRONIC - An adverse effect with symptoms that develop slowly over a long period of time or that frequently recur.

COMBUSTIBLE - Able to catch on fire and burn.

DOT - Department of Transportation

EPA - Environmental Protection Agency

FLAMMABLE - Capable of being easily ignited and of burning with extreme rapidity.

INFECTIOUS AGENTS - Sources that cause infections either by inhalation, ingestion, or direct contact with the host material.

LABORATORY SCALE - Work with chemicals that can easily and safely be manipulated by one person excluding the commercial production of chemicals for sale.

LABORATORY USE - A workplace where relatively small quantities of hazardous chemicals are used on a non-production basis.

LC 50 - The concentration of a substance in air that causes death in 50% of the animals exposed by inhalation. A measure of acute toxicity.

LD 50 - The dose that causes death in 50% of the animals exposed by swallowing a substance. A measure of acute toxicity.

MSDS - Material Safety Data Sheet

MUTAGEN - Capable of changing cells in such a way that future cell generations are affected. Mutagenic substances are usually considered suspect carcinogens.

OSHA - Occupational Safety and Health Administration, the regulatory branch of the Department of Labor concerned with employee safety and health. In Virginia, the Department of Labor & Industry is responsible for enforcing OSHA regulations. They are often referred to as Virginia Occupational Safety and Health (VOSH).

PEL - Permissible Exposure Limit. This is the legally allowed concentration in the workplace that is considered a safe level of exposure for an 8-hour shift, 40 hours per week.

pH - A measure of how acidic or caustic a substance is on a scale of 1 to 14. A pH of 1 indicates that a substance is acidic; and a pH of 14 indicates that a substance is basic.

PHYSICAL AGENTS - Workplace sources recognized for their potential effects on the body. Heat exposure or excessive noise levels are examples of this risk group.

SENSITIZERS - Agents to repeated exposure over time creating an allergic reaction at some point in time.

STERILITY - Changes made in male or female reproductive systems resulting in inability to reproduce.

TERATOGENS - A substance that causes a deformity in newborns if a significant exposure exists during pregnancy.

TLV - Threshold Limit Value. The amount of exposure allowable for an employee in an 8-hour day.

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