Chemical Hygiene Plan

EVMS
Eastern Virginia Medical School

Revised:
October 2021

INTRODUCTION

The Eastern Virginia Medical School (EVMS) Chemical Hygiene Plan (CHP) was developed to meet the requirements of the Occupational Safety and Health Administration (OSHA) standard on "Occupational Exposures to Hazardous Chemicals in Laboratories", 29 CFR 1910.1450: https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1450. The standard is known as the "Laboratory Standard."

Many laboratory chemicals are hazardous; however, if used properly in adequate facilities and with appropriate personal protective equipment, they may be used safely. The CHP establishes procedures, equipment and work practices to protect laboratory employees from physical and health hazards presented by laboratory operations. Each laboratory, whether research or clinical, is unique in design and available equipment. Employees must be familiar with hazards present in their laboratory, containment and storage equipment and emergency procedures. To accomplish this, a Laboratory Safety course is presented periodically.

We, as members of the Chemical and Environmental Safety Committee and staff in the EVMS Department of Environmental Health & Safety (EH&S), developed the CHP to be used as a working document for the laboratory personnel. A hardcopy version shall be available in every lab, and an electronic version is available on the EVMS MyPortal website. It is your responsibility to be familiar with its practices and procedures to minimize risk while working in the laboratory. Please contact EH&S with your questions, concerns and suggestions about safety.

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Chair, Chemical and Environmental Safety Committee

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Executive Director, Environmental Health & Safety

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Chemical Hygiene Officer

EMERGENCY TELEPHONE NUMBERS

Environmental Health & Safety .....(757) 446-5798
Emergency.....911
Fire and Life Safety Officer.....(757) 446-5990
Police and Public Safety.....(757) 446-5911
Fire.....911
Poison Control Center……..(800) 222-1222
EVMS PMA Care 24 Service (work related injury/illness)…….(833) 411-0153

Table of Contents

CHEMICAL HYGIENE PLAN

1. RESPONSIBILITIES

While each individual using chemicals is responsible for awareness of hazardous characteristics and safe use of the product, the EVMS administration is responsible for adopting chemical hygiene within the institution.

1.1 President, Provost and Dean

The President, Provost and Dean are responsible for supporting laboratory safety at EVMS.

1.2 Chemical and Environmental Safety Committee

The Chemical and Environmental Safety Committee meets quarterly and is responsible for reviewing and recommending institutional policy on the use, storage, and disposal of chemicals and to review and make recommendations on institutional policy concerning other non-biological hazards.

1.3 Department Chairman/Program Director

The Department Chairman or Program Director is responsible for laboratory safety in their department and supporting implementation of programs, practices, and procedures to achieve laboratory safety, including requirements in the Chemical Hygiene Plan.

1.4 Executive Director of Environmental Health & Safety

The Executive Director of Environmental Health & Safety is responsible for implementing programs, procedures, and practices necessary to meet requirements of Federal, State, and local regulatory agencies concerning health and safety and to identify resources required to accomplish these tasks.

1.5 Chemical Hygiene Officer

The Chemical Hygiene Officer (CHO) is an employee of EH&S and is responsible for daily operation of chemical hygiene at EVMS. Specifically, the CHO will:

- Review the Chemical Hygiene Plan annually and update it as necessary
- Develop and conduct training and information programs on laboratory safety to promote a safe work environment
- Provide technical assistance to investigators and laboratory staff on issues of laboratory safety
- Review application of chemical safety practices and procedures through periodic evaluation of laboratories and safety equipment such as eyewash stations, safety showers and fume hoods

- Investigate reported laboratory incidents and recommend corrective action to reduce potential for recurrence
- Maintain knowledge of Federal, State, and local regulations concerning hazardous materials use and disposal
- Manage disposal of hazardous materials and develop methods to minimize hazardous waste
- Provide the CHP as needed

1.6 Principal Investigator/Laboratory Supervisor

The Principal Investigator/Laboratory Supervisor is responsible for laboratory safety for their assigned spaces. They will:

- Be aware of hazards associated with laboratory materials used and inform laboratory staff of these hazards
- Select and employ laboratory practices and engineering controls to minimize the potential for exposure to hazardous materials and reduce the production of hazardous waste whenever possible
- Develop written standard operating procedures (SOPs) for each procedure involving hazardous substances to assure work practices, engineering controls and personal protective equipment are in place to reduce the potential for exposure to the lowest practical level. Procedures established by manufacturers or in textbooks can suffice as SOPs if they are identified as such and are kept with all other SOPs. See an example in appendix G.
- Ensure that laboratory staff receives laboratory safety training and employs practices
- and procedures identified in this CHP and the standard operating procedures of each protocol
- Make the CHP available to all laboratory personnel

1.7 Laboratory Employee/Staff

The Laboratory employee is responsible for safe use of hazardous materials in laboratories and following prescribed practices and procedures to minimize risk. Information provided by the Safety Data Sheets are a starting point to identify the hazards associated with chemicals. In addition, the employee shall immediately report to the Principal Investigator or Laboratory Supervisor all facts pertaining to accidents or unsafe conditions involving potential exposure to hazardous materials. The employee shall wear appropriate lab attire and understand the capabilities and limitations of personal protective equipment issued.

2. GENERAL LABORATORY SAFETY PROCEDURES

Laboratories contain many potential hazards for the untrained and uninformed individual. The hazards may include toxic chemicals, infectious materials, radioactive materials, hot surfaces, electric currents, glassware, systems under pressure, spinning devices, extremely cold items, a combination of these hazards or other hazards not mentioned. With proper training and an understanding of practices to reduce exposure to these materials, employees can perform assigned tasks with minimal health risk. While certain laboratory protocols require extensive safety precautions, most can be performed safely by observing these general procedures:

- Thoroughly wash your hands with soap and water to prevent ingestion of harmful materials before leaving the lab or handling food or drink
- Mouth pipetting is strictly prohibited
- Use proper personal protective equipment such as gloves, safety glasses, goggles, lab coat, closed toe shoes, etc.
- Contact lenses should not be worn when working with volatile chemicals
- Do not smell or taste chemicals
- Know the location of the nearest fire extinguisher and fire alarm pull-station
- Place broken glass or other sharp objects in puncture resistant containers
- Dispose of chemicals properly (See section 6)
- Store chemicals properly and minimize quantities handled (See section 4)
- Use a laboratory fume hood when working with volatile compounds (See section 7)

To summarize these general procedures, maintain good personal hygiene, store materials properly, be familiar with chemical characteristics and use adequate personal protective equipment and engineering controls. Employing these procedures will help achieve a safe and productive work area.

2.1 Eating, Drinking, Smoking in Laboratories

Eating, drinking, smoking, gum chewing, applying cosmetics and taking medicine in laboratories is strictly prohibited. Food, beverages, cups, and other drinking and eating utensils shall not be stored in areas where chemicals are handled or stored. Glassware used for laboratory operations should never be used to prepare or consume food or beverages. Laboratory refrigerators, ice chests, cold rooms, ovens and other equipment shall not be used for food storage or preparation. Laboratory water sources and deionized laboratory water should not be used for drinking water.

2.2 Children in Laboratories

Due to the nature of inherent hazards in laboratories, children shall not enter or be brought to laboratories unless in a learning activity that is under close supervision. Prudent oversight of the child's activities is necessary to avoid undue risks to the individual or other lab staff and distraction of the parent involved in laboratory studies. The fascination and curiosity of an unsupervised child can result in an unfortunate accident or injury.

2.3 Pregnancy

Reproductive toxins are substances that adversely affect the reproductive process. These toxins include mutagens that can cause chromosomal damage and teratogens, the effects of which include retarded fetal growth, birth defects, fetal malformations, and fetal death.

Knowledge of how chemicals affect reproductive health is in its preliminary stage. It has been only since 1973 that manufacturers were required by the Toxic Substances Control Act (TSCA) to test chemicals other than drugs for their effects on reproductive health.

Although a few well-controlled studies have been conducted, the evidence for most chemicals is limited to case reports or to studies done on a small group of exposed people after a problem emerged. Of approximately 100,000 chemicals (according to World Health Organization) that are produced on an industrial scale in commercial production (not including drugs, pesticides, and food additives) only a limited number have been tested thoroughly for reproductive effects.

Pregnant women and women intending to become pregnant should review Safety Data Sheets for special precautions before working with substances that are suspected to be reproductive toxins. As minimal precautions, the procedures outlined in Section 8 (Acutely Toxic Chemicals, Germ Cell Mutagens, Carcinogens, and Reproductive Toxins) should be followed for work with such compounds. They may also consult with EH&S personnel and/or her physician for further guidance.

3. SAFETY DATA SHEETS

3.1 General

OSHA requires chemical manufacturers and importers to develop or obtain a Safety Data Sheet (SDS) for each chemical they produce or import. SDSs contain information about the chemical, its physical and health hazards, and other Health & Safety data. Pictograms (Appendix D) are also present in SDSs to assist with hazard identification. SDSs are sent along with chemicals that are ordered by labs. It is a requirement that each laboratory shall have a binder containing the respective SDSs.

3.2 Description

All SDSs have specific sections that contain standard information about the chemical. The SDS includes the following information:

- Identify the substance designated on the container label
- Physical and chemical characteristics of the hazardous chemical
- Physical hazards
- Known acute and chronic health effects and related health information
- Primary routes of entry into the body
- Information on exposure limits
- Whether a hazardous chemical is considered a carcinogen by OSHA, the International Agency for Research on Cancer, or the National Toxicology Program
- Precautions for safe handling
- Generally acceptable control measures (engineering controls, work practices, personal protective equipment)
- Emergency and first aid procedures, including a 24-hour emergency phone contact.
- Date of SDS preparation or most recent revision
- Name, address, and phone number of the party responsible for preparing and distributing the SDS

The Hazard Communication Standard (HCS) requires chemical manufacturers, distributors, and importers to provide SDSs to communicate the hazards of hazardous chemical products. The HCS requires new SDSs to be in a uniform format (16 parts), and include the section numbers, the headings, and associated information under the headings below:

Section 1 – Identification of the substance or mixture

- GHS product identifier
- Other means of identification
- Recommended use of the chemical/restrictions on use
- Supplier details
- Emergency phone number

Section 2 – Hazards Identification
- GHS classification of the substance/mixture
- GHS label elements, including precautionary statements
- Other hazards that do not result in classification/not covered by GHS

Section 3 – Composition/Information on ingredients
- Chemical identity, concentration
- Common name, synonyms
- CAS number
- Impurities and stabilizing additives

Section 4 – First Aid Measures
- Description of necessary measures, subdivided according to the different routes of exposure
- Most important symptoms

Section 5 – Firefighting Measures
- Media to use in event of fire and special firefighting measures/PPE
- Specific hazards arising from the chemical

Section 6 – Accidental Release Measures
- Personal precautions, protective equipment, and emergency procedures
- Environmental precautions
- Methods and materials for containment and cleaning up

Section 7 – Handling and Storage
- Precautions for safe handling
- Conditions for safe storage, including any incompatibilities

Section 8 – Exposure Control and Personal Protection
- Control parameters
- Appropriate engineering controls
- Individual protection measures (PPE)

Section 9 – Physical and Chemical Properties
- Appearance, boiling point, flashpoint, specific gravity, etc.

Section 10 – Stability and Reactivity
- Chemical stability
- Hazardous reactions
- Conditions to avoid
- Incompatible materials
- Hazardous decomposition products

Section 11 – Toxicological Information

- Likely routes of exposure
- Symptoms/delayed and immediate effects/chronic effects
- Numerical measures of toxicity

Section 12 – Ecological Information

- Ecotoxicity
- Persistence and degradability
- Bioaccumulative potential
- Mobility in soil
- Other adverse effects

Section 13 – Disposal Consideration

- EPA and RCRA waste classifications and recommendations for disposal including any contaminated packaging

Section 14 – Transport Information

- DOT Labeling Requirements
- UN number/proper shipping name
- Transport hazard class
- Packing group
- Marine pollutant
- Special precautions

Section 15 – Regulatory Information

- Summary of reviews, standards and regulations, presenting toxicity and grant findings from IARC, ACGIH, OSHA, MSHA, NIOSH, EPA, NTP, etc.

Section 16 – Other Information

- Miscellaneous information and disclaimers

4. CHEMICAL USE AND HANDLING

Chemicals are essential components of laboratory research. Of paramount importance is minimizing the quantities used, which will reduce the amount that must be purchased and later disposed. The cost to dispose of partially used products can equal or exceed the initial purchase cost and increases with time. By using micro techniques, much smaller volumes of reagents are needed which requires fewer products purchased and stored.

4.1 Purchasing

When purchasing chemicals, be aware of handling and storage requirements. Ensure that laboratory staff has proper facilities and personal protective equipment to use and store the product. Order only quantities needed; surplus containers consume storage space and may decompose or become unstable when stored for long periods. Also consider that large "economy size" containers often dictate a need for other equipment such as smaller transfer containers, funnels, pumps, and labels, as well as additional time and labor to prepare smaller volumes.

4.1.1 Requisition

Complete the purchase requisition in accordance with directions provided by Materials Management. Use the 007326 object code to identify chemicals:

- 007326: Chemicals (e.g., solvents, acids, bases, reagents, etc.)

Example:

101	120	007326	000000

Note: 007301 – Office Supply – Use for toner, pens, paper, etc.
007307 – General Lab Supply – Tubes, glassware, etc.
007358 – PPE – gloves, safety glasses, safety goggles, etc.

These object codes should NOT be used when ordering chemicals

4.1.2 Receiving

When packages of chemicals are opened in the laboratory, laboratory personnel should verify that the container is intact and is labeled, at a minimum, with an accurate name on a well-adhered label. The users name and date of receipt should be placed on the label. New chemicals shall be immediately entered into the laboratory's inventory and placed in the appropriate storage area.

4.2 Inventory

An inventory of all chemicals in each laboratory must be prepared and updated by the lab. The purpose of the inventory is to know what chemicals and quantities are in the laboratory in event of an accident and ensure that SDSs are available to inform laboratory staff of potential chemical hazards. Each lab is responsible for the continual upkeep of their inventory by utilizing the online chemical inventory database, ChemTracker. ChemTracker is part of the BioRAFT platform and allows the user to preform many functions besides viewing and manipulating the chemical inventory. This online database will make SDSs and other safety related material (such as: chemical storage, hazard classes, and reports) easy to access. When a new chemical is received or consumed/removed, update the quantity in the online database. Additionally, an annual chemical inventory audit is required to ensure the inventory is accurate and up to date. Labs may query the database via EH&S to locate a needed chemical. EH&S maintains the user access list; if a member of the laboratory is leaving or being hired, notify EH&S to create a username and password. If a user cannot remember their username or password, contact EH&S at (757) 446-5798 for assistance. To access this database, go to: https://evms.bioraft.com/ and for more information read Appendix F.

4.3 Container Labels

Manufacturers, importers, and distributors must label all containers of hazardous chemicals. The label will often indicate how to store and handle the chemical, what protective clothing you should wear, and other safety procedures. All information on primary and secondary containers must be in English.

4.3.1 Primary Label

The label (example below) must contain the product identifier, pictograms, hazard statement, signal words, precautionary statements/pictograms and the manufacturer or importer information (example below). Hazard statements are indicated by standardized and assigned phrases that describe the hazard(s) as determined by hazard classification. Hazard pictograms convey health, physical and environmental hazard information, assigned to a GHS hazard class and category. The signal word indicates the relative degree of severity a hazard. The signal words used in the GHS are "Danger" for the more severe hazards, and “Warning” for the less severe hazards. Precautionary information supplements the hazard information by briefly providing measures to be taken to minimize or prevent adverse effects from physical, health or environmental hazards. The labels shall remain intact until the container is empty and shall be defaced before the container is discarded.

4.3.2 Secondary Container Labels

Chemicals are frequently transferred into smaller containers from bulk drums or other large containers. Each secondary container shall have a label that contains, at a minimum, a product identifier and words, pictures, symbols, or combination thereof which provide at least general information regarding the hazards of the chemicals, and which, in conjunction with other information immediately available to employees under the hazard communication program, will provide employees with specific information regarding the physical and health hazards of the hazardous chemical. Date of transfer, the name or initials of the person transferring the material, and/or expiration date may also appear on the secondary label. Abbreviations for chemical names are discouraged; however, if they are used a list of abbreviations must be posted prominently in the lab and in front of the SDS binder. Proper labeling of numerous small secondary containers prevents errors when adding reagents and enables proper disposal of the contents. An example of a secondary container label is illustrated below:

CHLOROFORM

Toxic and Carcinogen

Jane Doe 9-1-2021 Exp. 9-1-2022

NOTE: An exception to this requirement is secondary containers into which hazardous chemicals are transferred from labeled containers, and which are intended only for the immediate use (within the day) by the employee who performs the transfer.

4.4 Minimize

The American Chemical Society advocates a “Less Is Better” philosophy of hazardous waste management. It is based on reducing the amount of chemicals that may become waste. This can be done by either eliminating a specific chemical or reducing the quantity used.

To reduce the amount of hazardous wastes produced in a laboratory, it is prudent to consider how the chemical is used. Purchasing smaller quantities and replacement with alternate non-hazardous chemicals can effectively reduce hazardous waste produced. A smaller quantity purchased results in less unused chemicals being stored and reduces the potential for chemical exposure to personnel. Extended storage of unused chemicals increases the risk of accidents.

When developing laboratory protocols, consider using and ordering smaller quantities of chemicals. Disposing waste chemicals costs EVMS thousands of dollars per year and a large portion of the waste is from unused chemicals.

4.5 Laboratory Evaluations

To monitor the procurement, use, disposal, chemical safety practices and procedures of chemicals used at EVMS, annual Laboratory Evaluations are performed. The list of inspection items is included in Appendix A and includes an evaluation of the following areas:

- **Engineering Controls**
  - Fume Hoods
  - Eyewash Stations
  - Safety Showers
  - Compressed Gas Cylinders
  - Egress
  - Designated Areas
  - Sharps Containers
  - Fire Extinguishers

- **Handling Hazardous Materials**
  - Storage
  - Labeling
  - Disposal
  - Lab Practices
  - Personal Protective Equipment

- **Administrative Controls**
  - Chemical Hygiene Plan
  - Safety Data Sheets
  - Inventory

- **Training Requirements**
  - Chemical Hygiene Plan
  - Respirator
  - Special Hazards

5. CHEMICAL STORAGE

To reduce risk in event of an accident or fire, the quantity of chemicals stored in a laboratory must be kept at a minimum, consistent with needs of the investigator and fire code. As indicated in Section 4 (Chemical Use and Handling), all primary and secondary storage containers must be labeled to identify the chemical, its manufacturer or importer and the hazard warning. If there is a need to store large quantities of solvents, there are bulk chemical storerooms at Lewis Hall and Lester Hall. Contact EH&S at (757) 446-5798 for assistance about utilizing these areas.

5.1 Chemical Storage Method

Store chemicals by hazard classification (e.g., oxidizer, combustible, corrosive, unstable, water reactive, etc.) rather than alphabetical in cabinets or on open shelving not higher than eye level. Containers on shelves tend to "creep" or "walk" over time or in the event of an earthquake, so they should be restrained behind cabinet doors or with the use of a ¼ to ½ inch raised lip across the open front to prevent containers from falling off the shelf. To determine the chemical's hazard class, check the label for hazard information or consult the SDS. Be aware of the specific hazards of the chemicals being used and stored. The following is a list of general hazard class incompatibilities:

Examples of Incompatible Hazard Classes
Do not store List A chemicals next to List B chemicals

List A	List B
Organic	Oxidizer
Flammable	Oxidizer
Flammable	Poison
Poison	Corrosive
Acid	Base
Acid	Cyanide
Acid	Sulfide
Organic acid	Oxidizing acid
Water reactive	Aqueous solutions

See Appendix E for additional storage guidelines.

Once chemicals are segregated by hazard class, compatible classes can be stored together. Incompatible classes must be physically separated from each other. Separation of chemical groups can be by different shelves within the same cabinet; providing secondary containment is used to retain materials should the primary container be breached. Storage areas and containers should be inspected periodically for signs of deterioration (e.g., rust, corrosion, leakage, pressure build up, etc.). Several of the major chemical distributors have developed systems using a color code to define the groups that should be stored together. Unfortunately, although there are some similarities, the schemes of different companies are not wholly compatible.

5.2 Storage Quantities

5.2.1 Flammable Liquids

A flammable liquid is a liquid having a flash point of not more than 93°C (199°F). A flammable liquid is classified in one of four categories according to the following table:

Criteria for Flammable Liquids

Category	Criteria
1	Flash Point <23°C (73°F) and Initial Boiling Point ≤35°C (95°F)
2	Flash Point <23°C (73°F) and Initial Boiling Point >35°C (95°F)
3	Flash Point ≥23°C (73°F) and ≤60°C (140°F)
4	Flash Point >60°C (140°F) and ≤93°C (199°F)

Label Elements for Flammable Liquids

	Category 1	Category 2	Category 3	Category 4
Symbol	Flame	Flame	Flame	No symbol
Signal Word	Danger	Danger	Warning	Warning
Hazard Statement	Extremely flammable liquid and vapor	Highly flammable liquid and vapor	Flammable liquid and vapor	Combustible liquid

The maximum quantity of flammable and combustible liquids that can be stored in a laboratory outside a safety cabinet is 10 gallons (40 liters). If a safety cabinet is used, the maximum storage quantity is listed on the cabinet, usually 40 gallons (150 liters). Glass bottles containing flammable, or any other chemicals should not be stored on the floor in front of benches, since pedestrian traffic or items falling from the bench may break the bottles.

5.3 Peroxide-Forming Chemicals

Materials that are susceptible to peroxide formation are ones that typically react with air, moisture or impurities and produce a change in their chemical composition in normal storage. Peroxides may abruptly detonate with extreme forcefulness when concentrated by evaporation or distillation, when combined with other compounds, or when disturbed by heat, shock, or friction. Chemicals that are sensitive to peroxide formation can be broken into three categories (National Research Council. 2011. Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards, Updated Version. Washington, DC: The National Academies Press.) as shown in the following lists (bold are most common chemicals):

Class A: Form potentially explosive peroxides without concentration. All have been responsible for fatalities. Discard after 3 months.

- Butadiene
- Chloroprene
- Divinyl acetylene
- Isopropyl ether
- Potassium amide
- Potassium metal
- Sodium amide
- Tetrafluoroethylene
- Vinylidene chloride

Class B: Chemicals that form explosive levels of peroxides on concentration. Test for peroxide formation or discard after 12 months.

- Acetal
- Cumene
- Cyclohexene
- Cyclooctene
- Cyclopentene
- Diaacetylene
- Dicyclopentadiene
- **Diethyl ether**
- **Diglyme**
- Dioxane
- **Dimethoxyethane (DME)**
- Furan
- Methyl acetylene
- Methyl cyclopentane
- Methyl isobutyl ketone
- **Tetrahydrofuran**
- Tetrahydronaphthalene
- Vinyl ethers

Class C: Chemicals that may autopolymerize as result of peroxide formation. * Test for peroxide formation or discard after 12 months.

- Acrylic acid
- Butadiene
- Chlorotrifluoroethylene
- Ethyl acrylate
- Methyl methacrylate
- Styrene
- **Vinyl acetate**
- Vinyl chloride
- Vinyl pyridine

*Under storage conditions in the liquid state, the peroxide-forming potential increases and certain of the monomers should be discarded after three months.

Note: Class lists are illustrative but **not** comprehensive.

All compounds containing C-H bonds pose the risk of peroxide formation if contaminated with various radical initiators, photosensitizers, or catalysts. For instance, secondary alcohols such as isopropanol form peroxides when exposed to normal fluorescent lighting and contaminated with photosensitizers, such as benzophenone.

Any unopened container from the manufacturer must be tested or disposed of after 18 months.

Detection of Peroxide Formation in Laboratory Chemicals

Test 1:

Peroxide formation may be detected by visual inspection for crystalline solids or viscous liquids. If crystalline solids or viscous liquids are detected, **do not handle and immediately contact EH&S at (757) 446-5798 for assistance.**

Test 2:

Peroxide test strips that are available from scientific or safety vendors. Another peroxide detection test includes mixing 1 to 3 mL equal volume of test liquid and acetic acid. Add a few drops of 5% aqueous potassium iodide solution, and shake. The appearance of a yellow to brown color indicates the presence of peroxides. A test indicating a peroxide concentration greater than 100 ppm indicates a potentially dangerous level and the chemical should be disposed.

Required Work Practices

To minimize the hazard of peroxide formation, observe the following safety guidelines:

- *Any peroxidizable chemical with visible discoloration, crystallization or liquid stratification should be treated as potentially explosive.* ***Do not handle and immediately contact EH&S at (757) 446-5798 for assistance****.*

- Label all containers of peroxide-forming chemicals with the date the chemical was received and the date the container was opened.

- Use or discard containers by the manufacturer's expiration date. If there is no expiration date stamped on the container, discard according to the schedules listed above.

- Keep an inventory of peroxide-forming chemicals in the laboratory. NEVER purchase large containers of peroxide-forming chemicals if the quantity exceeds your actual need within the three- or twelve-month expiration period.

- **NEVER** distill potential peroxide-forming chemicals to dryness. Always leave a minimum of 20% of the original volume in the distillation apparatus. When possible, adding a non-volatile organic compound (such as mineral oil) can dilute the peroxides remaining after distillation. When preparing to distill or evaporate compounds listed in the tables above, always test for peroxides first.

- **NEVER** attempt to open a rusted or stuck cap on a peroxide-forming container.

- **NEVER** scrape or scrub glassware or containers that have been used with peroxide-forming compounds if you see an oily or crusty residue.

References

1. Jackson, H. L., McCormack, W. B., Rondestvedt, C. S., Smeltz, K. C., Vizle, I. E., "Control of Peroxidizable Compounds." J. Chem. Educ. 1970, 47(3), A175-88.
2. Kelly, R. J. "Review of Safety Guidelines for Peroxidizable Organic Chemicals." Chemical Health and Safety, September/October 1996, pp 28-36.
3. Kelly, R. J. and Miller, G. "Standard for Storing and Using Peroxidizable Organic Chemicals." Lawrence Livermore National Laboratory Publication. UCRL-AR-133218, Rev. 01 May, 1999.
4. National Research Council: Prudent Practices in the Laboratory – Updated Version. National Academy Press: Washington, DC, 2011.

5.4 Compressed Gas

Compressed gases and the cylinders containing them present both chemical and physical hazards. Depending on the gas there could be a hazard of fire, explosion, toxicity, or asphyxia due to the rapid diffusion of the gas into a laboratory space. Additionally the cylinder itself could become a projectile!

5.4.1 Ordering

When ordering compressed gas cylinders, order from vendors that exchange the cylinders or will take the cylinder back when empty. Compressed gas cylinders are very expensive to dispose. Prior to ordering a cylinder ensure there is adequate storage space within the laboratory or department. Specify delivery of the cylinder directly to the laboratory.

5.4.2 Storage and Use

Upon receipt, check the label on the cylinder to ensure the contents are the same as that ordered. Store the cylinder in a well-ventilated area and secure it with a clamp, belt, or chain above the midpoint (preferably 2/3 distance from the floor) to prevent the cylinder from falling over (see picture below). Proper free-standing cylinder restraints are also acceptable. Some gases (e.g. – carbon monoxide, silane) may have special requirements. Refer to the manufacturer's recommendations and/or contact EH&S for assistance.

When ready for use, move the cylinder using a cart and make sure the cap is secured. Compressed Gas Association threading exists to prevent mixing of incompatible gases due to an interchange of connections. Outlet threads vary in diameter; some are internal, others are external, and some are right handed and others left-handed. The threads on cylinder valves, regulators and other fittings should be examined to ensure they correspond to one another and are undamaged. Pressure regulators are specific to the type of cylinder. Never modify, force or tamper with these regulators.

NOTE: DO NOT LUBRICATE REGULATOR OR CYLINDER VALVES OR THREADS AS OIL OR GREASE ON THESE MAY CREATE AN EXPLOSION HAZARD.

Procedures for safe use of compressed gas cylinders:

- Identify the contents prior to use by checking the label
- If the cylinder cannot be positively identified, mark the cylinder with the words "CONTENTS UNKNOWN" and return to vendor – do not use
- Use the minimum size cylinder necessary
- Vent relief valves on cylinders of flammable, toxic or otherwise hazardous gases to a fume hood
- Never empty a cylinder completely; contamination could occur if the valve is left open
- Clearly mark the cylinder with an "EMPTY" tag when the contents are depleted
- Remove regulators from empty cylinders and re-install the cap at once
- Wear safety glasses or goggles when using compressed gas
- Do not use compressed gas to blow away dust or dirt since flying debris is an eye hazard

Examples of Poor Storage (What ***not*** to do!):

1. Gas line is directly connected to cylinder without a regulator; cylinder storage brackets are too high on wall; loose strap and no label of contents on left-hand cylinder
2. Cylinder is secured with a weak line that is tied to a moveable object (i.e. – a drawer)
3. Cylinder is not secured from falling; gas line is directly connected to cylinder without a regulator; safety cap is not installed

5.5 Refrigerators

Flammable and toxic chemicals should be stored in laboratory-grade refrigerators. Sparks from lamp connections, thermostats and fan switches may be ignition sources for flammable and combustible vapors. Additionally, laboratory workers generally place their face in the refrigerator when looking for samples, increasing the likelihood of inhaling unvented (toxic) vapors.

All chemicals in a refrigerator(s) must be properly labeled and no food or drink shall be stored in a laboratory refrigerator(s).

There are two types of laboratory refrigerators that reduce the risk of ignition of flammable vapors:

- "Explosion-proof" refrigerators are required only where there is a risk of ignition both inside and "outside" the unit.
- Explosion-safe or "laboratory-safe" refrigerators and freezers are more commonly used in the laboratory environment as they are designed to eliminate ignition of vapors "inside" the storage compartment by sources also within the environment. Associated design features include self-closing doors, special materials for the inner shell, and the location of the compressor and its controls at the top of the unit away from any potential floor-level accumulation.

NOTE: Regardless of the approach used, every laboratory refrigerator should be clearly labeled to indicate its intended use.

5.6 Environmental Rooms

Environmental rooms, either as refrigeration cold rooms or as warm rooms for growth of cells and organisms have the inherent property of being a closed air-circulation system. Thus, the release of any toxic substance in these areas poses potential dangers. In addition, because of the contained atmosphere in these rooms, there is a significant potential for the creation of aerosols and cross-contamination of research projects. These potential hazards shall be controlled by preventing the release of aerosols, gases, or volatile solvents into the room environment.

6. CHEMICAL DISPOSAL

EVMS is regulated by a variety of Federal, State, and local agencies to that require chemicals to be disposed in a safe and ethical sound manner. Therefore, the following requirements must be met:

1. DO NOT dispose of chemicals or chemical waste in the drains or general trash. Surplus chemicals or chemical waste will be picked up and disposed of by EVMS EH&S. Do not store hazardous waste in the lab for longer than six months.

2. Complete EHS-3 Form, "Request for Removal of Hazardous Chemical Waste" and submit to EH&S. See Appendix B for a copy of the form or fill it out on the EVMS MyPortal website.

3. Hazardous Waste Containers MUST have and use the EVMS Waste Label (example below) to identify stored contents and hazards. Labels are available from EH&S. All constituents of the waste, including the matrix, MUST BE included to total 100% of the waste. Matrices may include gloves, paper, plastic, glass, water, ethanol, etc. Abbreviations, chemical formulas, or trade names CAN NOT be used.

   "Unknown Wastes" will be handled on a case-by-case basis, and the generating department will be charged for its characterization.

4. Chemical MUST BE:
   Kept in closed containers that are compatible with the material.
   Containers must be leak-proof and provide headspace for expansion.

5. Keep solid and liquid forms of waste separate where possible; remember that contaminated articles such as gloves, absorbent pads, etc. constitute hazardous waste.

6. Segregate aqueous from organic wastes and halogenated from non-halogenated solvents where possible. Halogenated solvents contain Fluorine, Chlorine, Bromine, Iodine, or uncommonly Astatine within their composition. This helps to decrease disposal costs and increase the potential for recycling/reuse/reclamation options.

7. When wastes are “used” or “spent,” as opposed to surplus/obsolete virgin products. The latter may be offered for reuse within EVMS rather than disposed. If used or spent, be sure to note any contaminants in the waste.

8. Empty containers must be completely empty and free from any residual hazards. If the chemical is the sole active ingredient and it appears on the EPA P-Listed or U-Listed Waste Lists (found in 40 CFR Part 261.33) the container must be triple rinsed with an appropriate solvent, collecting the rinsate as hazardous waste. Finally, write the word EMPTY on the face of the label and dispose the container to general trash.

9. Mercury and chromium compounds require special disposal. Keep these wastes segregated and properly labeled.

10. Minimize wastes where possible by reducing volume on hand and substituting less hazardous chemicals for hazardous materials. Keep chemical inventories current and offer unused or unneeded chemicals for Chemical Morgue recirculation through EH&S. Contact EH&S at (757) 446-5798 for assistance in obtaining small quantities of chemicals or infrequently used chemicals via the Chemical Morgue or Chemical Inventory Search.

11. Store chemical waste only within distinctly segregated hazard classes, minimizing risk of reactions in the event of a release. Utilize grounding, ventilation, and containment devices where appropriate. Remember that flammable chemical waste is included in the 10-gallon limit of flammables permitted in the lab outside of an approved flammable solvent storage cabinet. Do not store chemicals or chemical waste in the aisles or where risk of breakage is likely.

12. Photographic chemicals from automatic developers in x-ray and other sources should be managed as hazardous wastes. Keep fixers and developers segregated.

13. See Section 5.3 for a list of some chemicals that form peroxides as they age, or upon exposure to air. Mark these products and wastes with the date received or prepared, date opened, and circle expiration date on virgin containers. These compounds become increasingly unstable and should be disposed of within 6 months of opening or 1 year from receipt if unopened. Do not keep peroxide forming chemicals beyond the expiration date.

    i. Sharps, broken glass, and other puncture causing items should be disposed of in sturdy, sealed puncture-resistant containers marked SHARPS or BROKEN GLASS. If blood-borne pathogens are present, the container must also bear the universal biohazard symbol seen below.

14. Dispose of waste containers promptly. Be sure to clear out wastes and unused chemicals prior to vacating the lab due to retirement, relocation, etc. Clean out refrigerators frequently, eliminating old and unknown items. Inform EH&S if the waste must be kept cold until ultimate disposition.

15. Above all, be careful! Respect chemical hazards. When in doubt, contact EH&S at (757) 446-5798 for assistance.

7. LABORATORY FUME HOODS

The laboratory fume hood is a form of local ventilation used to help prevent or reduce exposure to chemicals, fumes, and dusts. It also provides containment for reacting chemicals. Most exhaust directly outside and are frequently the only exhaust in a laboratory. Care must be taken not to obstruct airflow within the hood.

The EVMS Biosafety Procedure Manual discusses Biological safety cabinets.

7.1 Fume Hood Use

Successful fume hood operation depends on an adequate and uniform air velocity moving across the hood face, i.e., the open side of the hood. The face velocity and uniform pattern is modified by:

- Sash height (only on constant volume hoods)
- Bulky equipment
- Excess storage of containers in the hood
- Baffle adjustment

For most situations, an undisrupted hood face velocity of 100 linear feet per minute is desired with the sash open 12 to 18 inches. Face velocity is measured at nine points at the face of the hood with the sash lowered to normal working height. A high face velocity can cause turbulence, while a low face velocity may not completely exhaust hood contaminants. The most important factor in determining hood effectiveness is the user and their work practices. To achieve maximum protection based on hood design:

- Use the minimum sash height possible and use the sash as a physical barrier between the laboratory worker and the chemical
- Place work at least 6 inches inside the hood
- Place bulky items and equipment to the rear of the hood and raise it with blocks
- Obstructing the exhaust slots at the top and bottom of the rear wall disrupts the airflow and reduces the hood efficiency
- Ensure adequate illumination within the fume hood
- Place heat-generating devices in the rear of the hood as they may disrupt airflow
- Store only chemicals needed for the specific procedure being performed in the hood
- Wear personal protective equipment such as gloves, goggles or safety glasses, face shield, apron, lab coat, etc., based on the risk assessment of the procedure.

Prior to starting a procedure with hazardous materials in the fume hood, verify that the hood is operating properly. This can be done by checking airflow with an anemometer or a velometer or contact EH&S at (757) 446-5798 for assistance. Fume hood airflow is measured quarterly or more frequently depending on hood use. If the hood is not operating or alarming, notify EVMS Maintenance immediately at (757) 439-2745.

7.1.1 Fume Hood Types

There are two types of fume hoods on campus, Constant Air Volume (CAV) and Variable Air Volume (VAV).

Constant volume fume hoods exhaust a constant volume of air dependent of sash position. Because the volume is constant, the face velocity varies inversely with the sash position.

Variable air volume fume hoods exhaust a variable volume of air regardless of sash position. These hood styles are also known as *constant face velocity hoods*. As the sash is lowered or raised, the volume of air is increased or decreased which keeps the face velocity uniform at approximately 100 linear feet per minute. Most fume hoods across campus are VAV fume hoods. Please contact EH&S at (757) 446-5798 for assistance if an alarm is activated on your fume hood.

Regardless of fume hood type, the 12-to-18-inch maximum sash height is still recommended for splash protection. Close the fume hood sash entirely when not working at the hood; this saves utility costs and encloses the hood in the event of a chemical reaction or fire.

7.2 Perchloric Acid

Perchloric acid heated in a fume hood forms organic perchlorate vapor that condenses while passing through the exhaust system. When the condensed vapors reach a sufficient concentration an explosive situation may exist that can detonate upon contact during cleaning, modification, or repair. There are no perchloric acid hoods at EVMS. Perchloric acid hoods are generally constructed of stainless steel, welded seams and have water wash-down systems. If considering use of perchloric acid digestion, contact EH&S at (757) 446-5798 for assistance during the planning stage for consultation before any work is done and any chemicals have been procured.

8. ACUTELY TOXIC CHEMICALS, GERM CELL MUTAGENS, CARCINOGENS, AND REPRODUCTIVE TOXINS

Comprehensive health and safety information about the chemicals present in the laboratory, such as exposure limits, physical and health hazards, signs and symptoms associated with overexposure, appropriate work practices, equipment for preventing exposure to hazardous chemicals, and proper storage and disposal of hazardous substances can be found at the following links:

- NIOSH Chemical Hazards Guide – https://www.cdc.gov/niosh/docs/2005-149/default.html
- Permissible Exposure Limits – https://www.osha.gov/annotated-pels

If a new chemical is synthesized in the lab, to the best extent possible, all the same information and training is required as for any other hazardous material. The following are definitions of some toxic materials. Contact EH&S at (757) 446-5798 for additional information.

8.1 Definitions

Acutely Toxic

Acutely toxic chemicals have the ability to damage or severely interfere with living tissue. A chemical is considered acutely toxic if it meets one of the following criteria:

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

Germ Cell Mutagenicity

Chemicals that may cause mutations in the germ cells of humans that can be transmitted to the progeny.

Category 1: Known or Presumed Mutagen
- Sub-category 1A: Known Mutagen: Positive evidence from epidemiological studies
- Sub-category 1B: Presumed Mutagen: Positive evidence from human germ cell tests or in vivo tests
- Category 2: Suspected or Possible Mutagen

Carcinogen

Chemical substance or mixture that induces cancer or increases its incidence.

Category 1: Known or Presumed Carcinogen
- Sub-category 1A: Known Carcinogen: Positive human carcinogenic evidence
- Sub-category 1B: Presumed Carcinogen: Positive animal carcinogenic evidence

Category 2: Suspected or Possible Carcinogen

Reproductive Toxin

Chemicals that include adverse effects on sexual function and fertility in adult males and females as well as developing toxicity in the offspring.

Category 1: Known or Presumed Human Reproductive Toxin
- Sub-category 1A: Known Human Reproductive Toxin: Based on evidence from humans
- Sub-category 1B: Presumed Human Reproductive Toxin: Based on evidence from experimental animals

Category 2: Suspected human reproductive toxin

Other Category: Effects on or via Lactation

Prior Approval

Experiments that can be classified as high risk must receive prior written approval by the PI, Department Chair, and EH&S. These experiments must be conducted in a marked designated area segregated from normal operations of the laboratory. The designation of what constitutes a high risk should be determined by a thorough risk assessment. Some experiments may be classified as high risk because they utilize, generate, or have the potential to generate hazardous materials that present exceptional hazards. These materials include anything that can be classified under GHS as the following:
- Pyrophoric liquid
- Flammable gas that ignites spontaneously
- Organic peroxide, Type A-B
- Explosive, Division 1.1-1.3
- Self-reactive, Type A-B
- Acute toxicity, category 1-2 inhalation route exposure for any material which is a gas
- Acute toxicity, category 1 for any route of exposure
- Nanomaterials

Designated Area

A "designated area" means an area, which may be used for work with substances meeting the above criteria. This area may be the entire laboratory, an area of a laboratory or a device such as a chemical fume hood.

8.2 Procedures and Precautions

1. Work areas where materials that required prior approval are being used should be marked appropriately.

> CAUTION
>
> Designated Work Area
>
> Select carcinogens, reproductive hazards
> or substances of high acute toxicity may be present.

2. These areas should have controlled access and be entered only by persons authorized by the principal investigator or his or her designee. Access doors to these areas should be kept closed while experiments involving these materials are in progress. While working with these hazardous materials, assure two people are present and aware of what symptoms would appear if an exposure occurred.

3. All work surfaces should be covered with stainless steel or plastic trays, dry absorbent plastic-backed paper or other impervious material to contain any spills.

4. Review SOPs for each procedure involving these substances to assure work practices, engineering controls and personal protective equipment are in place to reduce the potential for exposure to the lowest practical level.

5. Use the appropriate hood for operations that might result in release of a toxic chemical vapor or dust. As a rule of thumb, use a hood or other local ventilation device when working with substances requiring prior approval.

6. When open benchtop procedures involve powders that meet the definition of acute toxicity, select carcinogen, or reproductive toxin, you may voluntarily wear a disposable NIOSH-approved N-95 respirator. The N-95 will protect against dust and mists with a TWA (Time Weighted Average) not less than 0.05 mg/m^3. You are encouraged to contact EH&S to perform a risk assessment to determine the appropriate PPE.

7. When work is completed, properly dispose of hazardous wastes. Collect chemical wastes and contaminated articles in appropriate containers for disposal. Decontaminate the controlled area before normal work is resumed there.

8. An accurate record of the amount of such substances being stored and of the amounts used, dates of use, and name of users shall be maintained in the laboratory.

Medical Consultation/Examination

The Laboratory Standard requires that laboratory personnel working with hazardous materials are provided with an opportunity to receive a confidential medical evaluation under the following circumstances:

- When an individual develops signs or symptoms (e.g. – irritation, dizziness, burning sensation in eyes or throat, skin irritation, lightheadedness, etc.) due to exposure to a chemical
- When routine air monitoring reveals chemical exposure above established limits
- When a spill or other incident results in the likelihood of a hazardous chemical exposure

When an employee needs immediate assistance for an injury that is life, limb, or eyesight threatening, they should call 911 Emergency Services. The employee must follow up with the PMA Care 24 Nurse Call Service (Injuries/Illnesses) at (833) 411-0153 as soon as they can report the injury. In addition, they must notify their supervisor.

When an employee needs assistance for an injury that does not need Emergency Services, the employee should call PMA Care 24 Nurse Call Service (Injuries/Illnesses) at (833) 411-0153. Service is available 24/7/365. The nurse will recommend if the injury is self-care or if medical attention is required.

9. EMPLOYEE INFORMATION AND TRAINING

The Chemical Hygiene Officer will provide laboratory employees with information and training concerning the hazards of chemicals present in the laboratories. To accomplish this, "General Laboratory Safety" courses (Chemical Hygiene Plan Training) are presented on a regular basis. Newly hired laboratory employees will be informed of the next available course by their Principal Investigator or supervisor and are required to attend. Information and training will be provided in accordance with OSHA's standard on "Occupational Exposures to Hazardous Chemicals in Laboratories," 29 CFR 1910.1450. Refresher training is required five years after initial training is completed.

9.1 Informational Requirements

Employees will be informed of:

- The contents of the "Laboratory Standard" and its appendices that shall be made available to employees
- The location and availability of EVMS's Chemical Hygiene Plan
- The permissible exposure limits for OSHA regulated substances or recommended exposure limits for other hazardous chemicals where there is no applicable OSHA standard
- Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory
- The location and availability of known reference material on the hazards, safe handling, storage, and disposal of hazardous chemicals found in the laboratory including, but not limited to Safety Data Sheets received from the chemical supplier

9.2 Employee Training

Employee training will include:

- Methods and observations that may be used to detect the presence or release of a chemical (such as monitoring, continuous monitoring devices, visual appearance or odor of chemicals when being released, etc.)
- The physical and health hazards of chemicals in the work area
- The measures employees can take to protect themselves from these hazards,
- including specific procedures EVMS has implemented to protect employees from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures and personal protective equipment to be used
- The applicable details of EVMS's written Chemical Hygiene Plan

10. PERSONAL PROTECTIVE EQUIPMENT

Personal protective equipment (PPE) includes all clothing and other work accessories designed to create a barrier against workplace hazards. These barriers are intended to protect the eyes and face, hands and arms, and body. Laboratory workers must be aware that PPE does not eliminate the hazard; if the PPE fails or is improperly used, exposure will likely occur. An assessment of the laboratory environment at EVMS indicates that at a minimum a laboratory coat (flame-retardant is recommended), gloves and eye protection should be worn during procedures involving wet chemistries or similar manipulations with toxic or corrosive materials. Personal protective equipment shall be made available to employees by their Principal Investigator.

10.1 Eye and Face Protection

The most likely incident involving the eye or face is a chemical splash. Protection from chemical splashes is attained by wearing safety glasses, goggles or a face shield. Safety glasses are impact resistant and offer minimal protection from other than a direct splash. Side shields are available that increase protection from the side. Goggles cover the eyes and reduce the likelihood of splashes entering the eye from above, below or the sides. Most goggles provide both impact and splash protection, and are available to fit over corrective lenses.

Contact lenses shall not be worn where chemical splashes or organic vapors may be present. In event of a chemical splash, it is challenging to remove the contact lens to irrigate the eye due to involuntary spasms of the eyelid. Additionally, gases and vapors may concentrate under the contact lens and cause permanent eye injury.

Face shields cover the eyes, face, and throat, providing protection when working with systems under pressure and reactive mixtures. They should always be worn with primary eye protection such as safety glasses or goggles.

Please contact EH&S at (757) 446-5798 for assistance in selecting eye protection.

10.2 Hand Protection

Gloves create a barrier between the hand and contact with hazardous materials. Selecting the correct type of glove depends on the work practice and chemicals used. Each type of glove material (butyl, neoprene, nitrile, latex, etc.) is tested against various chemicals to determine its permeability and break through time. Refer to glove materials and break through charts from vendors to determine the type of glove that is suitable for your application. Gloves selected for chemical resistant properties also protect against dry powders.

10.3 Thermal Hand/Arm Protection

Special gloves may be necessary to handle items at extreme temperatures – both cold and hot. Select gloves based on their intended use and check their specifications against the temperatures to be encountered. For arm protection, use gloves with gauntlets or over-sleeves. Most laboratories should have one or two pair of these special gloves or related items that are reusable.

10.4 Protective Apparel

Upon arrival at the laboratory, either working at the bench-top or not, proper lab attire is required. Either arrive at the laboratory wearing the proper lab attire or bring a change of clothes and shoes that follow appropriate lab attire listed below. Having that extra layer of material between skin and the experiment prevents possible contamination, burns, cuts and death.

Appropriate attire in the laboratory is as follows:

- Pants covering the ankles, or long dress not made of excess material (e.g. – bell skirt)
- Closed toe, protective shoes
- Non-dangling jewelry and clothing
- Restrained long hair, tied back

The following items should not be worn in a laboratory:

- Loose or dangling clothing or jewelry
- Shorts
- Unrestrained long hair
- Sandals or other open toe shoes

In most instances, a laboratory coat provides adequate barrier protection from minor chemical splashes and contact with other hazardous materials. Most lab coats however, are combustible! In situations involving a fire, the lab coat as well as other fabrics, such as rayon and polyester may present an additional hazard to the wearer. A flame-retardant lab coat should be considered in these instances as well as not wearing synthetic materials that are prone to melt when exposed to fire or heat.

When working with large quantities (e.g., 4 liters of a corrosive liquid) of chemicals, a chemical-resistant apron is required to protect against splashes or a spill. Chose a laboratory apron that is resistant to solvents, acids, and chemicals you use.

11. MOVING PROCEDURE

This procedure applies to investigators who are vacating or relocating to previously established laboratories within EVMS. Refer to Appendix H (Guidelines for EVMS Research Laboratory Closure) for specific information.

11.1 Movement of Potentially Contaminated Equipment

Movement of potentially contaminated equipment, (refrigerator/freezers, centrifuges, vortexes, benchtops, etc.) must be approved and the equipment must be surveyed and tagged by EH&S before it is transferred to another area. It is the responsibility of the laboratory to provide effective decontamination/deactivation of the various hazards involved and to complete the movement of the equipment within 30 days of being tagged. After approval, equipment will be tagged as follows:

Eastern Virginia Medical School
Environmental Health and Safety

This equipment has been disinfected and or decontaminated and is approved for release for transfer or disposal.

Inspected by: _____

Date Verified: _____

This safety verification is invalid if the equipment is utilized again and expires after 30-days.
757-446-5778.

11.3 Researcher Reporting Requirements

Researchers who are moving labs within EVMS are reminded to update their Radioactive Material Possession and Use Forms, Chemical Inventories and Institutional Biosafety Committee approvals with the proper laboratory locations and any changes that may occur during the move.

NOTE: If laboratory equipment is to be discarded, be aware that capacitors, transformers, mercury switches, mercury thermometers, radioactive sources and chemicals must be removed before disposal.

12. EMERGENCY PROCEDURES

12.1 General

Laboratories contain hazardous materials that may be spilled or released from reactions or as result of fire. The most common incident involves spilling liquid chemicals from a glass container. Response to the incident depends on the chemical involved, extent of personal injury, and facility damage. Information about the chemical(s) involved is available in the SDS and the identification should be made by the user, if present. Once the chemical is identified, specific steps will be directed by EH&S to reduce the hazard and clean up the material.

12.2 Spill Response

Response to a chemical spill must occur at several levels. For laboratory workers, some spills must be cleaned-up at the first level - theirs. There are other times when EH&S must manage the spill.

For the purpose of this procedure, a spill is defined as "a material out of control." In a practical sense, the quantity of material is not important. The essential issue is whether the hazards, the location and the quantity cause the situation to be beyond the control of the laboratory worker.

Certain spills must be reported, regardless of the quantity (beyond *de minimis*).

- All spills of extremely flammable materials (flash point less than 20°F) must be reported
- All spills of extremely toxic materials ($\leq$5 mg/kg LD_{50}) must be reported.
- All mercury spills must be reported
- All personal contaminations must be reported
- All uncontrolled compressed gas releases must be reported

Personnel are responsible to have procedures for spills that are below the reportable level. These procedures are explained below.

The primary consideration for laboratory personnel when a material is spilled is safety. Safety for every person in the laboratory and in the building is of paramount importance. If the spill could potentially harm someone, contact EH&S at (757) 446-5798 or EVMS Police and Public Safety at (757) 446-5911 for assistance. Otherwise, the laboratory workers who will clean-up the spill must follow specific procedures to do so safely and effectively.

1. **Personal Protective Equipment (PPE)**
   Before attempting to clean-up a spill, the lab responder must put on the following minimum amount of personal protective equipment (PPE):
   - Safety glasses
   - Lab coat
   - Nitrile or latex gloves

2. Clean-up Materials

Laboratories must have certain supplies available before attempting to clean-up a spill. The actual materials to be used will depend upon the hazards posed by the spilled material. A recommended list of supplies is presented below:

- Absorbent pads
- Absorbent socks
- Acid neutralizer
- Activated carbon
- Caustic neutralizer
- Dustpan and brush
- Heavy-duty plastic trash bags
- Laboratory tongs
- One or five gallon plastic bucket with lid

Note: This procedure is not applicable to spills of mercury, radioactive or biological materials.

3. Clean-Up Procedure

i. PPE

Don the appropriate PPE. If, during the spill or subsequent actions, any person exposed to a chemical, refer to the manufacturers Safety Data Sheet for First Aid guidance.

ii. Control

Control the source of the spill if it is still present. A bottle, for example, which was knocked over, will still have some material in it. The responder should carefully upright the container, place it on an absorbent pad in a safe location and replace the lid on the container. Any spread of spilled material must also be controlled. This is best done by placing absorbent pads or socks around and on the spill. Many laboratory spills involve broken glass. The spill responder must be careful to avoid being cut.

iii. Absorb/Remove

- **Acidic, Caustic, or other Non-Flammable Liquids**

  These are most easily absorbed with absorbent pads and socks. Place used absorbent pads and socks in a trash bag. Frequently, laboratory spills will spread into drawers and behind or under equipment. The responder must be careful to locate all such contaminated areas.

- **Flammable Liquids**

  Flammable liquids should be absorbed on activated carbon or absorbent pads and socks. Use approximately 2 pounds of activated carbon per pint (0.5 liters) of liquid. Use the dust brush or spatula to mix the activated carbon with the liquid thoroughly. Use the dustpan and brush to collect all residues. Remove large pieces of broken glass as described in the next step and place all other debris in a plastic trash bag or appropriate container.

iv. Remove broken glass

Using tongs or gloved fingers carefully remove all large pieces of glass and place them in an appropriate container.

v. Decontaminate:

- **Acidic Liquids**
  Apply acid neutralizer on all surfaces affected by the spill. Soak up the neutralizer and apply fresh neutralizer. Remove the residues with absorbent pads or paper towels and then thoroughly wash the affected area with hot soapy water. Use absorbent pads to finish cleaning the area.

- **Caustic Liquids**
  Apply caustic neutralizer on all surfaces affected by the spill. Soak up the neutralizer and apply fresh neutralizer. Remove the residues with absorbent pads or paper towels, and then thoroughly wash the affected area with hot soapy water. Use absorbent pads to finish cleaning the area.

- **Flammable Liquids**
  Thoroughly wash the area with hot soapy water. Use absorbent pads to finish cleaning the area.

vi. Container

Use absorbent pads, neutralizers, and hot soapy water as appropriate; to remove all traces of spilled material from the container. Remember to clean the bottom of the container.

vii. Inspect

Carefully check the entire affected area for spill residue, hidden contamination, or unsafe conditions, and act accordingly.

viii. Package Spill Residues

Place all spill residues and contaminated PPE in plastic bags. Seal the bags and place in the bucket or other appropriate container. Complete a chemical waste removal request form and submit to EH&S for collection. The form can be accessed on the EVMS MyPortal website.

ix. Restock Spill Supplies

Gather and restock supplies as needed.

NOTE: Other initial procedures may be appropriate for specific chemicals, consult the SDS before use to be aware of recommended spill procedures.

12.3 Follow-up Actions

Decontamination and cleanup are under the direction of EH&S and laboratory staff will assist as requested by EH&S staff.

12.4 Injury

Emergency – report to the Emergency Room, Sentara Norfolk General Hospital in event of severe bleeding, head injury, broken bones, respiratory distress or other life-threatening injuries. If patient transport or paramedic services are necessary, dial 911. Report the injury to EVMS PMA Care 24 Service at (833) 411-0153.

Non-emergency – If the injury is not an emergency but requires treatment, call the EVMS PMA Care 24 Nurse Call Service. A registered nurse will triage the injury/illness and provide further guidance. Report the injury to your supervisor.

NOTE: You may be responsible for all medical expenses incurred if you do not report the injury to EVMS PMA Care 24 Service.

12.5 Decontamination and Chemical Waste

Decontamination supplies and personal protective equipment are kept by EH&S. The EH&S staff is trained to wear respiratory protection and has a variety of respirator cartridges available depending on the chemical involved. Chemical waste, including contaminated absorbents and articles, must be prepared, and labeled for disposal. Broken glass must be placed in puncture resistant containers for proper disposal, keeping in mind that it may also be contaminated.

EMERGENCY TELEPHONE NUMBERS

Environmental Health & Safety .....(757) 446-5798
Emergency.....911
Fire and Life Safety Officer.....(757) 446-5990
Police and Public Safety.....(757) 446-5911
Fire.....911
Poison Control Center……..(800) 222-1222
EVMS PMA Care 24 Service (work related injury/illness)…….(833) 411-0153

Please post the Emergency Telephone Numbers in the lab near the telephone.

Appendix A: Lab Evaluation Check List

- **Engineering Controls**
  - Fume Hoods
    - Is the fume hood face velocity between 80 lf/m and 120 lf/m?
    - Is the fume hood clear of stored materials and equipment?
    - Is the fume hood operating properly? If not, has a work order been submitted?
    - Is a fume hood present?
  - Eyewash and Safety Shower Stations
    - Have the eyewash and safety shower passed an inspection in the past two weeks?
    - Are the eyewash and safety shower identified with highly visible signs?
    - Are the eyewash and safety shower unobstructed?
    - Are the eyewash and safety shower within 55 feet (10 seconds) from the laboratory?
    - Are the nozzles to the eyewash station protected from airborne contaminants?
    - Is the eyewash a plumbed unit?
  - Compressed Gas Cylinders
    - Are compressed gas cylinders stored in a well-ventilated area?
    - Are empty cylinders marked with an "empty" label?
    - Are cylinders stored with their caps on when not in use?
    - Do cylinders contain a label identifying the contents and manufacturer?
    - Is each cylinder secured from falling with straps, chains or clamps?
  - Egress
    - Are laboratory aisles unobstructed to allow easy access/exit?
    - Is the laboratory maintained in a clean and organized state?
  - Designated Areas
    - Are work areas containing acutely toxic substances and carcinogens clearly marked?
  - Sharps Containers
    - Is contaminated waste disposed of properly?
  - Fire Extinguishers
    - Is an ABC type fire extinguisher accessible in the laboratory?

- **Handling Hazardous Materials**
  - Storage
    - Are chemicals stored compatibly?
    - Are chemicals stored alphabetically within their classification?
    - Are chemicals segregated by classification?
    - Is the total volume of stored flammable solvents in the flammable storage cabinet below the stated limit?
    - Is the volume of flammable solvents on the bench top less than 10 gallons?
    - Are halogenated solvents segregated from non-halogenated solvents?
  - Labeling
    - Are chemicals/compounds labeled properly?
    - Are secondary containers properly labeled?
  - Disposal
    - Are chemicals disposed of properly into chemical waste containers?
    - Are peroxide formers dated on arrival and disposed of according to by consensus standard timelines?
    - Do chemical waste containers list contents by name and percent composition?

- Lab Practices
  - Is glassware cleaned with liquid detergent and water?
  - Are highly toxic and reactive chemicals present in the laboratory?
  - Are organic peroxide containers dated and disposed of properly?
  - Does the lab only use mercury-free thermometers and equipment?
  - Are "No Food or Drink" labels clearly displayed on each refrigerator, freezer, and microwave present in the laboratory?
  - Is the lab void of electrical hazards?
  - Is all equipment located outside of the PI's laboratory labeled with the PI's emergency contact information?
  - Is the laboratory void of evidence of eating, drinking, and applying cosmetics in the laboratory?
- Personal Protective Equipment
  - Are all personnel wearing appropriate footwear?
  - Is appropriate eye protection maintained in the laboratory and used when necessary?
  - Are appropriate gloves maintained in the laboratory and used when working with hazardous materials?
  - Are all personnel wearing appropriate laboratory attire?
  - Are lab coats worn when working with biological, chemical, and/or radioactive materials?
  - Are respirators available and used when necessary in the laboratory?

- **Administrative Controls**
  - Chemical Hygiene Plan
    - Is a copy of the EVMS Chemical Hygiene Plan present and accessible in the laboratory?
  - Safety Data Sheets
    - Does the laboratory maintain Safety Data Sheets for each chemical present in the laboratory?
  - Inventory
    - Is the laboratory's chemical inventory complete and up-to-date on ChemTracker?

- **Training Requirements**
  - Chemical Hygiene Plan
    - Have all laboratory personnel completed Chemical Hygiene Plan training?
  - Respirator
    - Have all personnel who require the use of a respirator completed Respiratory Protection training and been fit tested for a respirator?
  - Special Hazards
    - Has special training been completed by all personnel who work with and handle high hazard chemicals?
    - Are hazard evaluations and employee training records maintained in the laboratory?

Appendix B: Request for Removal of Hazardous Chemical Waste

Print Form Clear Form Email Form

EVMS
Eastern Virginia Medical School

Request for Removal of Chemical Waste

Use separate form for each container

General Information:

Generator of Waste: _____
Department: _____
Building and Room Number: _____
Principal Investigator: _____
Office Phone Number: _____
Email Address: _____

Identification of Waste Chemicals:

List the chemical name in the fields below. Do not list abbreviations, formulas, or trade names. This list must match the information on the waste container. List all components in percentages to total 100 percent. Include contaminants and trace chemicals (if present).

Chemical	Percent

Total Quantity:

Liters for liquid waste, Kilograms for solid waste

_____ (Liters / Kilograms)

Comments:

Use this area to write special comments about the waste and precautions that the handlers should observe. List type of container (glass, metal, plastic, or other).

_____
_____
_____
_____
_____
_____

This material is properly described, has appropriate labels, and is in a proper container for handling.

_____ _____
Signature: Date:

DEPARTMENT OF ENVIRONMENTAL HEALTH & SAFETY

PO BOX 1980
700 W OLNEY ROAD
LEWIS HALL 2132
NORFOLK, VA 23501-1980
TEL 757.446.5798
FAX 757.446.7242
www.evms.edu

EHS USE ONLY
Accumulation Start Date: _____
Tag Control Number: _____

Community focus. World impact.

EHS-3 REV. 03/14

Appendix C: EVMS Mercury Policy

It is the goal at EVMS to reduce or eliminate mercury-containing devices (e.g. thermometers, sphygmomanometers, esophageal dilators, barometers, etc.) in keeping with the goals of the Memorandum of Understanding (MOU) between the U.S. Environmental Protection Agency (EPA) and the American Hospital Association (AHA). This agreement in 1998 implemented pollution prevention actions within hospitals. One of the top priorities of the MOU was to eliminate mercury-containing waste from hospital waste streams by 2005. This goal is important because of the toxic effects of mercury on human health and the environment.

Mercury occurs in several forms. It may occur naturally in the environment as elemental mercury (quicksilver); it may be dissolved in rainwater as (Hg^{+2}); it may appear in solid mineral form as cinnabar (HgS); and as methyl mercury ($HgCH_3$), an organo-metal. Biotransformation of inorganic mercury in the environment to methyl mercury enables entrance into food chains. Methyl mercury is the most toxic form of mercury to animals and humans. Mercury can cause human health problems when it accumulates in the tissue of fish and other aquatic animals that are used as a human food source. Elimination of methyl mercury occurs very slowly with various half-lives of months to years.

Because of mercury's toxic effects, all departments, laboratories and clinical areas are urged to remove mercury-containing devices from their spaces and replace them with suitable non-mercury equivalents. Where no alternatives are available, mercury-containing equipment should be appropriately labeled as hazardous. EH&S will collect discarded mercury-containing devices and manage them as hazardous waste.

Principle Sources of Mercury at EVMS:

- Thermometers
- Sphygmomanometers (blood pressure devices)
- Barometers
- Lab chemicals
- Fluorescent lights
- Data projector lights
- Special lights and lamps

References:

A Guide to Mercury Assessment and Elimination in Healthcare Facilities, Department of Health Services, State of California, September 2000
Eliminating Mercury in Hospitals, EPA, November 2002
Memorandum of Understanding Between the United States Environmental Protection Agency and the American Hospital Association, June 1998
Mercury, EPA web site
National Survey Finds Most Hospital Eliminating Mercury, Hospitals for a Healthy Environment, September 2005

Appendix D: GHS Pictograms/Hazard Ratings

Health Hazard  • Carcinogen • Mutagenicity • Reproductive Toxicity • Respiratory Sensitizer • Target Organ Toxicity • Aspiration Toxicity	**Flame**  • Flammables • Pyrophorics • Self-Heating • Emits Flammable Gas • Self-Reactives • Organic Peroxides	**Exclamation Mark**  • Irritant (skin and eye) • Skin Sensitizer • Acute Toxicity • Narcotic Effects • Respiratory Tract Irritant • Hazardous to Ozone Layer (Non-Mandatory)
Gas Cylinder  • Gases Under Pressure	**Corrosion**  • Skin Corrosion/Burns • Eye Damage • Corrosive to Metals	**Exploding Bomb**  • Explosives • Self-Reactives • Organic Peroxides
Flame Over Circle  • Oxidizers	**Environment**  (Non-Mandatory) • Aquatic Toxicity	**Skull and Crossbones**  • Acute Toxicity (fatal or toxic)

Hazard Category Ratings through GHS

Be aware of the fact that a significant change has occurred with respect to hazard ratings under GHS. Numeric hazard ratings in GHS are the OPPOSITE of what they were with the Hazardous Materials Identification System (HMIS) and the National Fire Protection Agency (NFPA). Now, the lower the rating, the higher the hazard! The numeric hazard ratings for a chemical will be included on the SDS. In most cases, this should be found in the Hazards Identification section, section 2.

Appendix E: Chemical Storage Requirements

Stanford University Compatible Storage Group Classification System
Should be used in conjunction with specific storage conditions taken from the manufacturer's label and MSDS.

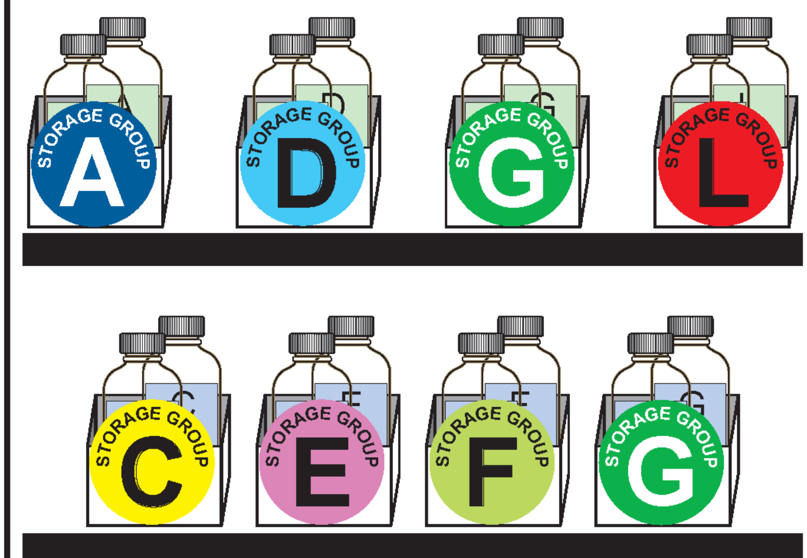
STORAGE GROUPS

Store chemicals in separate secondary containment and cabinets

A	Compatible Organic Bases
B	Compatible Pyrophoric & Water Reactive Materials
C	Compatible Inorganic Bases
D	Compatible Organic Acids
E	Compatible Oxidizers including Peroxides
F	Compatible Inorganic Acids not including Oxidizers or Combustible
G	Not Intrinsically Reactive or Flammable or Combustible
J*	Poison Compressed Gases
K*	Compatible Explosive or other highly Unstable Material
L	Non-Reactive Flammable and Combustible, including solvents
X*	Incompatible with ALL other storage groups

***Storage Groups J, K and X: Consult EHS Department**
For specific storage - consult manufacturer's MSDS

If space does not allow Storage Groups to be kept in separate cabinets the following scheme can be used with extra care taken to provide stable, uncrowded, and carefully monitored conditions.



Storage Group X must be segregated from all other chemicals.

Storage Group B is not compatible with any other storage group.

Code	Storage Groups	Examples
A	Compatible Organic Bases	• BIS TRIS • Diethylamine • Imidazole • Triethanolamine
B	Compatible Pyrophoric and Water Reactive Materials	• Tert-Butyllithium • Sodium Borohydride
C	Compatible Inorganic Bases	• Sodium Hydroxide • Ammonium Hydroxide
D	Compatible Organic Acids	• Acetic Acid • Maleic Acid
E	Compatible Oxidizers including Peroxides	• Nitric Acid • Periodic Acid • Perchloric Acid • Potassium Permanganate
F	Compatible Inorganic Acids not including Oxidizers or Combustibles	• Phosphoric Acid • Hydrochloric Acid • Sulfuric Acid
G	Not Intrinsically Reactive or Flammable or Combustible	• Acrylamide • Sodium Bisulfate • Coomassie Blue • Sodium Chloride
J	Poison Compressed Gases	• Ethylene Oxide • Sulfur Dioxide
K	Compatible Explosive or other highly unstable materials	• Picric Acid, Dry • Tetrazole • Ammonium Permanganate
L	Non-Reactive Flammables and Combustibles, including solvents	• 1-Butanol • 1-Propanol • Acetic Anhydride • Acrolein • Formamide • Sigmacote
X	Incompatible with All Other Storage Groups	• Sodium Azide • Picric Acid, Moist • Arsine

Appendix F: Chemical Inventory: ChemTracker Information

Overview
EVMS requires all laboratories to maintain an inventory of all chemicals and report annually on the types, quantities and locations where these chemicals are being stored and used. The chemical inventory must be submitted to EH&S on an annual basis. EH&S will compile all the annual chemical inventory reports and submit the reports to the appropriate Federal, state, and local government agencies as part of the Community Right-to-Know Program. EH&S will perform a Security Vulnerability Assessment as part of the Department of Homeland Security Chemical Facility Anti-Terrorism Standards. To facilitate this inventory process, EVMS has implemented the ChemTracker Chemical Inventory System.

ChemTracker is a web-based inventory system for chemical management within research laboratories and facilities. Authorized ChemTracker users may update chemical inventory information, prepare reports, and obtain chemical safety information. ChemTracker also allows users to:

- Track all chemicals by location, owner, container, and among other criteria
- Link directly to Safety Data Sheets and additional safety information
- Look up hazard, toxicological, and physical references
- Identify specific chemical containers by unique barcode
- Save money and space by reducing or eliminating unnecessary purchases
- List chemicals in surplus and search for other surplus chemicals
- Increase efficiency by making chemicals easier to locate in storage and location groups
- Identify chemicals with specific shelf life and storage requirements

Applicability
Chemical inventories must be maintained in ChemTracker and updated regularly to reflect the typical quantities of chemicals present in that area. For example, if an area typically maintains approximately four 4-liter bottles of ethanol, the four bottles would be entered into ChemTracker. The inventory does not need to reflect the routine inventory fluctuations associated with general use and re-ordering.

Responsibilities
EH&S maintains the user and chemical owner accounts in ChemTracker; audits the chemical inventory data; prepares and submits chemical inventories to appropriate government agencies; and provides assistance and training on the use of ChemTracker.

Principal Investigators: Ensure a chemical inventory for their area(s) is (are) maintained and updated in the ChemTracker database; informs EH&S on changes in staff to be added or removed from ChemTracker.

Chemical User: Add and delete chemicals on a regular basis for your Principal Investigator. Audit chemical inventory annually and search for chemical hazards and SDS as needed.

Exclusions
Chemicals/materials that are excluded from inventorying are:

- Licensed Radioactive materials
- Biological/Biohazardous Materials (e.g., enzymes, antibodies, custom DNA / RNA sequences)
- FDA-approved drugs and medications
- Any consumer products in the same form and concentration that are used in the workplace in the same manner as normal consumer use and the use results in a duration and frequency of exposure which is not greater than exposures experienced by consumer (e.g., household bleach, dishwashing detergent, vinegar, et al.)
- Working solutions (materials that will be used or disposed within the day)
- Growth Media and Non-hazardous Buffers

The ChemTracker inventory system, which is located in the BioRAFT platform, is a very useful management system and makes adding, deleting, and editing chemicals relatively intuitive. EH&S can always assist if required. ChemTracker is located at the following address: https://evms.bioraft.com.

Laboratory Specific
Standard Operating Procedures

Eastern Virginia Medical School
Department of Environmental Health & Safety
Lewis Hall Room 2132
(757) 446-5798

Building: _____ Room: _____
Department: _____ PI: _____

Section 1: (check one)

☐ Process ☐ Hazardous Chemical ☐ Hazard Class

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

Section 3: Potential Hazards

Section 4: Personal Protective Equipment

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

Laboratory Specific Standard Operating Procedures

Guidelines for Preparing SOPs

Section 1: Check the appropriate box indicating process, chemical hazard, or hazard class
Section 2: Describe process, hazardous chemical, or hazard class

- *Process- Describe the process and list all chemicals involved*
- *Hazardous Chemical- List the chemical name, common name and any other abbreviations*
- *Hazard class- Describe the hazards associated with a particular group of similar chemicals, list the ones used in the lab*

Section 3: Potential Hazards. Describe both physical and health hazards associated with process, hazard, or class

Section 4: PPE. Indicate the level of PPE needed including (but not limited to) gloves, goggles, face shields, aprons, and lab coats

Section 5: Engineering Controls. List the engineering controls used to prevent and reduce exposure
- Example: Fume hoods

Section 6: Special Handling and Storage Procedures. Indicate specific areas used for storage, including storage compatibility. List policies regarding access and dating procedures, such as dating peroxide formers.

Section 7: Spill and Accident Procedures. List who and how spills will be handled. Indicate where emergency equipment is located and the location of emergency numbers.

Section 8: Decontamination Procedures. List procedures including cleaning solutions and solvents that may be used.

Section 9: Waste Disposal. Indicate which substances are required to be picked up by hazardous waste. Ensure all hazardous waste is appropriately labeled "Hazardous Waste" and has a ticket on it.

Section 10: MSDS Location. Indicate the location of all MSDS and any other chemical or safety manuals in the lab.

Section 11: Protocol. List specific procedures for working with this particular process, chemical hazard, or hazard class.

Appendix H: Guidelines for EVMS Research Laboratory Closure

Guidelines for EVMS Research Laboratory Closure

This policy has been developed to facilitate the process of laboratory closure when an investigator is vacating or relocating, as well as full and partial laboratory renovations. The Principal Investigator (PI) is responsible for ensuring that all procedures and necessary documents will be performed and all necessary signatures on the BioRAFT Lab Closing Form will be obtained before vacating a lab or renovations begin.

The Principal Investigator (PI) is responsible for executing the required tasks as outlined here as well as in the EH&S policies & guidelines. The PI is responsible for coordinating with their lab staff to ensure the removal of all chemical, radioactive, and biohazardous materials and the decontamination of lab surfaces and associated equipment in which their work was conducted. The PI is also responsible for negotiating and/or coordinating the proper transport/transfer of lab equipment to its designated location as agreed upon by the department and the institution. (Note: In most cases, the PI does not own the lab equipment purchased using start-up funds or grants.) The PI must also schedule a final lab inspection by EH&S to officially be approved for lab closure.

The Department Chair is responsible for meeting with the PI as soon as notification is given regarding lab closure in order to discuss proper procedures, verify and approve the timeline for the lab close-out as well as determine retention/removal of lab equipment.

Department Business Manager (BM) provides administrative support to the vacating lab. In the event that the vacating PI cannot be held accountable for their responsibilities, the Department BM will contact the proper parties for the next course of action.

Environmental Health & Safety Office (EH&S) provides technical guidance and advice in accordance with relevant outside agencies to address the proper handling, transfer, and disposal of regulated biological, chemical, radiological materials, and equipment. EH&S will be responsible for conducting the Lab Closure Inspection and issuing official determination that all procedures have been met to approve lab close-out by notifying the PI, Department Chair, Office of Research and HR.

Lab Close-Out: A process that results in the final inspection by EH&S to verify that the process of removing all the accessible chemical, biological and radioactive materials, equipment, consumables, and any unwanted papers/catalogs, as well as any related contamination from accessible surfaces was performed by the responsible user (PI). Final approval by EH&S will confirm that the laboratory can be safely reused by other staff or undergo renovations by contractors.

Partial Close-Out: A process in which a specified area within a lab space is closed-out with the understanding that construction in the space will be confined to the area that underwent a decontamination process and final close-out inspection by EH&S.

Violations on following the Guidelines for EVMS Research Laboratory Closure might result in a delay with an approval and Chair of the Department final signature on Part 2 of the BioRAFT Laboratory Closure Form.

For your convenience a Lab Closure Timeline Checklist is provided in this document beginning on page 57 and the Lab Closing Procedures are listed beginning on page 59.

Lab Closure Timeline Checklist

At least 8–12 weeks before closing the lab:

- The PI: Notify Chair of the Department and Department Business Manager about a partial or complete close-out of the laboratory. Schedule an initial meeting with the Chair of the Department to discuss the transition and close-out process and to complete Part 1 of the BioRAFT Laboratory Closure Form.

- The PI: Notify IBC Administrator and/or the Biosafety Officer of the upcoming partial or complete lab closeout to request all necessary documents you will need to complete in the coming weeks. The BioRAFT Laboratory Closure Form (Part 1) MUST BE signed by the Chair of the Department and PI at the initial meeting.

- Department Chair: During the initial meeting, notify the PI about PI responsibilities for a proper close-out of the laboratory, verify and approve the timeline for the lab closure as well as determine a plan for retention/removal of lab equipment. Completed Part 1 of the BioRAFT Laboratory Closure Form.

- The PI: Within one (1) week of initial meeting, notify the following individuals about initiation of the lab close-out timeline and dates of final inspection/approval for the lab closing (see Step 2 of the BioRAFT Laboratory Closure Form: Part 1):
  - Comparative Medicine
  - IRB
  - EH&S
  - Office of Research (IACUC and/or IBC)
  - Faculty Affairs
  - Human Resources

- The PI: Schedule a consultation meeting with EH&S/ Materials Management/ Office of Research/ Office of Business Affairs within 30 days of completing Part 1 of the BioRAFT Laboratory Closure Form to coordinate equipment and materials movement.

- The PI: Contact IACUC and Veterinary Services to assist with animal protocol close-out and animal transport/housing/disposal planning. Contact IRB to assist with human research protocol close-out. Contact Office of Research regarding Intellectual Property issues.

4 -6 weeks before closing the lab:

- Wipe down all surfaces, cabinets, equipment and fume hoods with an appropriate disinfectant or detergent solution.

- Notify EH&S Environmental Compliance of impending unwanted material/waste or surplus chemical removal that will need to be scheduled for collection/disposal. Submit all appropriate forms to EH&S department.

- If the laboratory is relocating, pack chemicals, equipment, supplies, and samples for moving or shipping. Contact EH&S to assist with biohazard and chemical packing and shipping. EH&S Radiation Safety must ship or transfer any radioactive materials.

- Have all chemical, biological, radioactive, and sharps waste and gas cylinders removed.

- Dispose of any remaining uncontaminated glass or non-hazardous materials.

2 weeks before closing the laboratory:

- Clean out all cabinets, drawers, desks, refrigerators, freezers, fume hoods, biosafety cabinets.

- Do not plan to leave any materials behind unless prior arrangements have been agreed upon by the department and the institution.

- Properly decontaminate and secure all equipment for transport/transfer/retention to its designated location as agreed upon by the department and the institution.

- Schedule a date and time for the Lab Closure Inspection with EH&S.

Just before closing the laboratory:

- Wipe down all surfaces, cabinets, equipment and fume hoods with an appropriate disinfectant or detergent solution.

- Attend the final Lab Closure Inspection conducted by EH&S to obtain official approval for the close-out and receive EH&S final signature in BioRAFT Laboratory Closure Form: Part 2.

- After all requirements for lab-close-out have been completed and all signatures have been collected, schedule the final meeting with Department Chair to request the Final Signature of the BioRAFT Laboratory Closure Form: Part 2. Send the signed form to the IBCA (ibc@evms.edu) to upload and close your bio-registration in BioRAFT.

Lab Closing Procedures

Lab Closure Process Early Closure Steps (8 - 12 Weeks Prior to Vacating Space)

1) Notify the Chair of the Department and Business Manager of the department about the lab closing and schedule a meeting to discuss your lab closeout timeline and dates. Complete Part 1 of the BioRAFT Laboratory Closure Form at the initial meeting.

2) Notify the IBCA/Office of Research and/or EVMS Biosafety Officer of the upcoming lab closing and request all the necessary documents to complete during the closing procedures.

3) Meet with the Department Chair to discuss plans for proper transport/transfer of lab equipment to its designated location as agreed upon by the department and the institution. (Note: In most cases, the PI does not own the lab equipment purchased using start-up funds or grants.)

4) Notify all relevant parties associated with your active research projects: Comparative Medicine, IRB, EH&S, Office of Research (IACUC Administrator and/or IBC Administrator), Faculty Affairs and/or Human Resources about initiating the process of lab closure.

5) Schedule a consultation meeting with EH&S/ Materials Management/ Office of Research/ Office of Business Affairs within 30 days of completing the BioRAFT Lab Closing Form: Part 1 to coordinate equipment and materials movement, if necessary.

6) Contact appropriate parties to inquire/begin the process of completing each department's lab closing requirements: IACUC and Veterinary Services to assist with animal protocol close-out and animal transport/housing/disposal planning; Contact IRB to assist with human research protocol closeout; Contact Office of Research regarding Intellectual Property issues, and etc.

Lab Closure Steps (4 - 6 Weeks Prior to Vacating Space)

1) If the lab space will be renovated before another PI moves in, the Departmental Business Manager should contact Capital Projects/Facilities to make them aware of the impending lab closure.

2) If hazardous materials are to be shipped to another location/institution or will travel to another laboratory via public roads, the PI should consult with EH&S on vendor selection, proper packing, moving, and/or shipping of these materials. The PI will notify EH&S of the need for unwanted material/biohazard/chemical waste at least 4-6 weeks before the anticipated collection date.

3) EH&S will need to evaluate the volume and coordinate material/biohazard/chemical pickups, which may need to be done in stages over the course of several weeks. Gas cylinders should be returned to the original companies according to those companies' procedures.

4) The PI will need to coordinate moving equipment to another institution after it is properly

cleaned and decontaminated and only after the department/institution has agreed to the equipment status.

5) If lab equipment is flagged for disposal, the PI must contact EH&S at (757) 446-5798 for pick-up/disposal assistance *only* after the department/institution has agreed to the equipment status.
   i. Equipment containing potentially hazardous materials must be picked up by EH&S.
   ii. Please be aware that certain equipment must have hazardous components (Freon, oil, lead, radioactive sources) removed before they are disposed of, sometimes by an outside vendor, which can take time. For example, refrigerators must have the Freon removed. Be sure to contact Environmental Compliance if you have any questions.

6) If no renovation will be taking place, you may leave equipment behind that has been clearly marked for the oncoming PI, or is departmental/institutional equipment. Unwanted equipment needs to be submitted for pickup by the PI in coordination with a Business Manager of the Department.

2 Weeks Before Closure

1) The PI will properly label all chemical containers and biological waste materials that are to be picked up by EH&S.

2) The PI will then complete the Request for Pickup forms for the disposal or reallocation of all chemicals not included in a laboratory cleanout, as well as biological waste, sharps, and universal waste/equipment to be removed by EH&S.

3) Unless it has been arranged for equipment to stay behind, it needs to be removed as regulated equipment or universal waste.

4) The PI will ensure that radioactive waste is transferred to EH&S using the standard waste pickup procedure.

5) The PI should determine how remaining viable chemicals, supplies, and equipment will be reallocated if they no longer wish to keep these materials
   - The PI can donate chemicals and supplies to other labs
   - Only the Chair of Department/Institution can approve donation of unwanted equipment to other investigators, otherwise all equipment becomes departmental/institutional property
   - Lab fridges should not be used or donated for non-lab use
   - There are limitations and restrictions to relocating and donating materials:
     - *Highly hazardous/regulated materials should not change hands without prior approval!*
   - The donation or disposal of any radioactive materials or equipment used with radioactivity should first be cleared with EH&S, as they will need to survey the equipment and approve the transfer

Just Before Closure

1) The PI may need to continue to submit surplus chemicals and chemicals/biologicals/equipment determined to be unwanted material/hazardous waste to EH&S. Any unwanted material, abandoned chemicals or equipment left behind may delay closure of the lab, and subsequent renovation.

2) The PI will pack, move, and/or ship all non-hazardous materials in the laboratory (if PI is moving to other location). If large appliances or other equipment are being left behind for the next investigator or deemed property of the department/institution, mark them in some fashion to state this intent.
   - For intra-campus moves, please contact EH&S at (757) 446-5798 for guidance on packing container selection and route selection in order to avoid high traffic, carpeted areas

3) The PI will perform a final visual survey of the lab spaces to ensure that no unwanted material/hazardous waste, chemicals, gas cylinders, sharps, or other materials remain in the lab. Uncontaminated glass waste should be sealed in a plastic bag-lined cardboard box for regular trash collection. Remember to empty refrigerators, desk drawers, and under-sink areas. All lab spaces and other rooms (dark rooms, microscope rooms, supply storage) under the control of the PI should be emptied unless the PI leaves equipment/reagents requested by the Department.

4) The PI is responsible for making sure all items are removed from the laboratory space. Please submit all materials for proper disposal within an appropriate amount of time (2-4 weeks). The lab closeout cannot take place if any material is left behind.

5) It is the responsibility of the PI to update the Institutional Biosafety Committee (IBC) bio-registration in BioRAFT to reflect changes in location/personnel and/or to complete the bio-registration for final closeout review. The BioRAFT bio-registration *WILL NOT be officially closed* until the BioRAFT Laboratory Closure Form: Part 2 is complete (with ALL signatures) and has been received by the IBCA.

When laboratory has been vacated

1) The Business Manager of the Department in a coordination with the PI, will notify EH&S about the lab space(s) clearance.

2) EH&S will inspect the lab areas/spaces, and if they pass inspection, EH&S will sign the BioRAFT Laboratory Closure Form: Part 2, and approve the lab closeout.
   - EH&S Laboratory Closure SIGNATURE in Part 2

3) The PI obtains all necessary Laboratory Closure SIGNATURES in Part 2 of the BioRAFT Laboratory Closure Form. Only if all PI responsibilities and requirements have been deemed complete, will each designated party member sign Part 2.

4) The PI will schedule a Final Lab Closure Meeting with the Chair of the Department to provide final updates and logistical details.

- Department Chair will provide the final SIGNATURE in Part 2 of the BioRAFT Laboratory Closure Form

5) The PI will email the FINALIZED Part 2 (with all SIGNATURES) to the IBCA (IBC@evms.edu).

In Unusual Circumstances

1) If the PI changes his/her status to "volunteer faculty", the PI needs to notify IBC about changes. The PI retains active BioRAFT protocol and performs/directs work in the laboratory according to EVMS Biological Safety Manual.

2) In the case of closing the laboratory, the PI should adhere to the Guidelines for EVMS Research Laboratory Closure.