TENNESSEE STATE UNIVERSITY

CENTER FOR MICRO-, NANO-, & BIO-TECHNOLOGY RESEARCH (CMNBTR) USER'S MANUAL

RESEARCH & SPONSORS PROGRAMS

2016

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POLICIES AND PROCEDURES

I. Introduction

The Center for Micro-, Nano-, and Bio-Technology Research (CMNBTR) facility consist of 5 laboratories equipped with a variety of tools for your laboratory and research needs. The success or failure of any lab is determined by user etiquette, cleanliness, and policy compliance. All the time, money, and effort spent to establish a scientific work environment would be to no avail if users do not believe in and help enforce these policies. It is also recognized that technology is continually changing and lab users are a tremendous resource of new ideas. With this in mind, it is strongly encouraged to recommend changes that may make these facilities safer, cleaner, easier to use, or less expensive to maintain. When in the laboratories, be aware of your knowledge limitations. It is extremely important to seek help if you are unsure about the operation of these facilities.

II. Enforcement

The policies and procedures described here are intended to ensure the safety of all users, protect the very complex and expensive equipment in the laboratories and to create an environment in which many different research groups can co-exist. It is expected that lab users will police themselves by encouraging and assisting one another in adhering to these policies. Safe work offenders will be penalized, typically through suspension or expulsion from all CMNBTR laboratories. The penalties are clearly defined in this manual.

III. Equipment Schedule Rules

Schedule runs in advance whenever possible, do not monopolize equipment. Comply with your schedule, 15 min. maximum hold of equipment before position is queue is lost. Remove tooling (boats, 96 well plates, etc.) from systems and clean-up after each use. Note and report any anomalies to the next user and staff.

IV. Access to the CMNBTR Laboratories

The CMNBTR laboratories are equipped with a Card Access System, which limits access to authorized users only. Users must have their ID card in order to enter the CMNBTR labs. The card system will record the times of entry and exit for each user. Prior to being granted access to the CMNBTR labs, applicants must attend an orientation session on laboratory safety and procedures. Handouts will be provided at this session including the CMNBTR Laboratory Safety Manual and various policy and procedure handouts. Applicants must sign a form acknowledging they have read and understood the contents of the handouts. Applicants are also required to take an exam on the contents of the CMNBTR Laboratory Safety Manual and handouts. Authorized users are able to come in at any time the CMNBTR labs are open. However, all users are required to use and follow the "Buddy" System.

V. Buddy System

The buddy system **MUST ALWAYS** be used in the CMNBTR laboratories. As implemented here, the buddy system requires a minimum of two people inside the CMNBTR laboratories at all times and they should both be authorized users. This is to ensure the safety of all users. A list of emergency phone numbers are located in all CMNBTR labs and in the corridor outside the CMNBTR labs.

VI. Safety Procedures

- Use special care to keep fume-hoods and biosafety cabinets in ultra-clean conditions.
- Emergency exit doors are ***ONLY*** for **EMERGENCIES.**
- In case of an alarm, exit immediately. **DO NOT** take the time to retrieve personal items or remove personal protective equipment until you are clear of the building.
- ***IMPORTANT –*** Hot plates (one of the main causes of laboratory fires):
    - Never leave them on when unattended.
    - Make ***SURE*** that the temperature is: 20°C BELOW flash point of contents and 20°C BELOW melting point of beaker materials.
    - Ask for help if you are unsure of any part of the process.

- Do not walk around unnecessarily and be cautious when approaching another user's work space.
- Storage of excess stuff is not permitted in any CMNBTR laboratories
- If you turn it ON, remember to turn it OFF

  Exceptions: Those pieces of equipment that must be left on all day for practical purposes
- If you make a mess, clean it up. Return everything to its original condition, or better.
  - This includes your entire set-up of experiments or projects.
- Users will make proper entry into the logbook each time a piece of equipment that has a logbook is used.
- Be aware of supplies. If quantities of stock appear to be low, report it to the CMNBTR laboratory staff.
- Do not **add or remove** items from the labs without the laboratory staff's permission.
- If you require a special equipment set-up, consult the CMNBTR laboratory staff or your P.I.
- If an incident may have adversely affected someone's work or equipment, find the owner and agree on a proper remedy for the accidental interference.

VII. Exercise Caution and Good Judgment

- Obey signs on equipment or in specific areas.
- Refill empty squirt bottles.
- Let empty solvent jugs evaporate to dry. Rinse acid and base jugs three times with tap water before placing in appropriate cart.
- When working with acids, bases or solvents, wear chemical resistant nitrile/neoprene gloves and apron available in each lab.
  - Before using the gloves, be sure they are in good condition. Replace them if they are torn.

- Do not dump solvents down the drains. Use the solvent waste jugs located at the Fume Hoods.
- Dispose waste chemicals as Halogenated organic, Non-Halogenated organic, solid waste, Acid/ base, or toxic metals waste or others as appropriately indicated in each lab procedure.
    - Always record the amount and identity of the waste on the Hazardous Waste label. *Hazardous Waste labels can be found online under the Center's website.*
- When disposing of acid mixtures, dilute with lots of tap water.
- Label all unattended mixtures with chemical safety warning sheets available in all CMNBTR laboratories

VIII. Safety Equipment

- Protective clothing (lab coat, gown, apron, etc.) is to be worn in the lab at all times (especially during procedures) and removed before leaving the lab
- Gloves are to be worn at all time (especially during procedures)
    - Alternatives to latex gloves are available for individuals with latex sensitivity
    - Gloves should be changed regularly or when necessary (when contaminated, or when its integrity is compromised)
    - The reuse and washing of disposable gloves is prohibited
    - Contaminated gloves properly disposed of (e.g. in biohazard trash)
    - Gloves are to be removed before touching "clean" surfaces (telephones, keyboards, door, etc.) AND before leaving the lab
- Face protection (goggles, mask, face shield or other splatter guards) must be used for anticipated splashes or sprays of chemicals, infectious or other hazardous materials to the face, when samples must be manipulated outside the fume hood or BSC
- Protective eye wear must be worn during procedures that have the potential to create splashes, sprays, aerosols, shards, etc.
- All operations involving reactive or explosive chemicals must be conducted behind blast shields or in fume hood with the sash lowered

- A fume hood or BSC should always be used when operations might result in the release of toxic chemicals or biological vapors, dust, aerosols, splashes, etc.
    - As a rule of thumb, use a fume hood or other local ventilation device when working with any appreciably volatile substance with a threshold limit value (TLV) of less than 50 ppm.
    - Confirm adequate hood/BSC performance before use. Keep hood sash closed at all times except when adjustments within the hood are being made.
    - Keep materials stored in hoods/BSCs to a minimum and do not allow materials to block vents or air flow
    - Leave the hood/BSC "ON" if toxic substances are stored in it or if it is uncertain whether adequate general laboratory ventilation will be maintained when hood is "OFF".

IX. Standard Practices

- Proper lab attire is required (no shorts, skirts, torn clothes or shoes, sandals, open-toed shoes, loose hair, or loose clothing)
- Appropriate Personal Protective Equipment (PPE) should be worn at all times. PPE must include, but not limited to goggles, safety glasses, face mask, gloves, face shield, acid apron, etc.
- Always wash hand after handling viable materials and animals, after removing gloves, and before leaving the laboratory
- No eating, drinking, smoking, chewing gum, applying cosmetics, handling contact lenses, combing or brushing or hair while in the lab
- Storing, handling, or consuming food or beverages in storage areas, refrigerators, glassware, or utensils that are also used for laboratory operation is prohibited.
- Handle and store laboratory glassware with care to avoid damage; do not use damaged glassware
- Do not smell or taste chemicals
- Always inspect gloves before using

- Never allow the release of toxic substances in cold rooms and other confined spaces, since these have contained re-circulated atmospheres
- Use only those chemicals for which the quality of the available ventilation system is appropriate
- Mouth pipetting is prohibited
- Practical jokes or other behavior that might confuse, startle, or distract another worker are not acceptable.
- Keep the work area clean and uncluttered, with chemicals and equipment properly labeled and stored; clean up the work area on completion of an operation and at the end of each day.
- Seek information and advice about hazards, plan appropriate protective procedures, and plan the positioning of equipment before beginning any new operation
- Be well prepared to work in the laboratory; read procedures, Material Safety Data Sheets (MSDS), chemical labels, and prepare for any hazards prior to starting any experiment.
- All procedures should be prepared in a careful manner to minimize the creation of splashes or aerosols
- All work surfaces should be wiped down with an effective cleaner or disinfectant on completion of work, at the end of the day, and especially after overt spills or splashes of chemicals or biomaterials
- Contaminated or damaged/torn gloves should be replaced immediately.
- All syringes, needles, and sharps are disposed of in rigid, puncture-resistant, leak-proof containers
- Use a fume hood or BSC for all operations that might result in the release of toxic chemical or biological vapors or dust
- Never place your head in the fume hood or BSC
- Do not wear excessive or dangling jewelry in the lab
- Report adverse changes in environmental conditions (particle generation or accumulation, marked changes in humidity or temperature) and/or personal changes in physical condition (profuse sweating, a nasal discharge, adverse skin conditions, etc.) to the laboratory Staff.

- Properly label all chemicals that have been removed from their original containers
- Be aware of unsafe conditions and see that they are corrected immediately when detected by bringing them to the attention of a supervisor or the Safety Officer

X. Chemical Warning Labels

Frequently, CMNBTR lab users will leave items under fume hoods overnight or for part of the day, unattended. The policy is simple: ANYTHING left unattended MUST be labeled with your

- NAME,
- PHONE NUMBER WHERE YOU REALLY CAN BE REACHED,
- CHEMICAL NAME,
- DATE AND TIME of when you left it
- DATE AND TIME of when you will return for it.

The staff will THROW OUT anything not appropriately labeled, no questions asked. For the protection of all, complete the Chemical Safety Warning form available in all CMNBTR labs and online.

XI. Broken and Stained Glassware and Other Sharp Objects

With all the glassware used in the CMNBTR labs, breakage or permanent contamination will occasionally occur, or things will get contaminated beyond the point of being cleanable. If glassware meeting these criteria are observed, dispose of it in the container marked ***"Sharp Objects Only."***

- Biohazardous contaminated items should be placed in the appropriate biohazard sharp waste container

Exercise care when disposing of any glass: injuries can occur when sharp objects are discarded improperly.

- Mechanical means, such as a brush and dustpan, tongs, or forceps should always be used to clean up broken glassware

Used disposable needles must never be bent, sheared, broken, recapped, removed from disposal syringes, or otherwise manipulated.

XII. MSDS/SDS

MSDS/SDS folders are located in all CMNBTR laboratories. A MSDS/SDS must be given to the CMNBTR laboratory staff **BEFORE** any new chemical is brought into any CMNBTR laboratory. MSDS/SDS are usually shipped with chemicals or can be located on line from different manufacturers.

It is very important that you familiarize yourself with the information on the MSDS/SDS for **ALL** chemicals you intend to use in the CMNBTR laboratories. Make sure to ask your PI or CMNBTR laboratory staff, if you are unsure of any procedure, potential chemical hazard, or proper precautions for chemical handling.

OSHA® QUICK CARD™

Hazard Communication Safety Data Sheets

The Hazard Communication Standard (HCS) requires chemical manufacturers, distributors, or importers to provide Safety Data Sheets (SDSs) (formerly known as Material Safety Data Sheets or MSDSs) to communicate the hazards of hazardous chemical products. As of June 1, 2015, the HCS will require new SDSs to be in a uniform format, and include the section numbers, the headings, and associated information under the headings below:

Section 1, Identification includes product identifier; manufacturer or distributor name, address, phone number; emergency phone number; recommended use; restrictions on use.

Section 2, Hazard(s) identification includes all hazards regarding the chemical; required label elements.

Section 3, Composition/information on ingredients includes information on chemical ingredients; trade secret claims.

Section 4, First-aid measures includes important symptoms/effects, acute, delayed; required treatment.

Section 5, Fire-fighting measures lists suitable extinguishing techniques, equipment; chemical hazards from fire.

Section 6, Accidental release measures lists emergency procedures; protective equipment; proper methods of containment and cleanup.

Section 7, Handling and storage lists precautions for safe handling and storage, including incompatibilities.

(Continued on other side)

For more information:

U.S. Department of Labor

OSHA® Occupational Safety and Health Administration

www.osha.gov (800) 321-OSHA (6742)

OSHA 3493-12R 2013

OSHA® QUICK CARD™

Hazard Communication Safety Data Sheets

Section 8, Exposure controls/personal protection lists OSHA's Permissible Exposure Limits (PELs); ACGIH Threshold Limit Values (TLVs); and any other exposure limit used or recommended by the chemical manufacturer, importer, or employer preparing the SDS where available as well as appropriate engineering controls; personal protective equipment (PPE).

Section 9, Physical and chemical properties lists the chemical's characteristics.

Section 10, Stability and reactivity lists chemical stability and possibility of hazardous reactions.

Section 11, Toxicological information includes routes of exposure; related symptoms, acute and chronic effects; numerical measures of toxicity.

Section 12, Ecological information*
Section 13, Disposal considerations*
Section 14, Transport information*
Section 15, Regulatory information*

Section 16, Other information, includes the date of preparation or last revision.

*Note: Since other Agencies regulate this information, OSHA will not be enforcing Sections 12 through 15 (29 CFR 1910.1200(g)(2)).

Employers must ensure that SDSs are readily accessible to employees.
See Appendix D of 29 CFR 1910.1200 for a detailed description of SDS contents.

For more information:

U.S. Department of Labor

OSHA® Occupational Safety and Health Administration

www.osha.gov (800) 321-OSHA (6742)

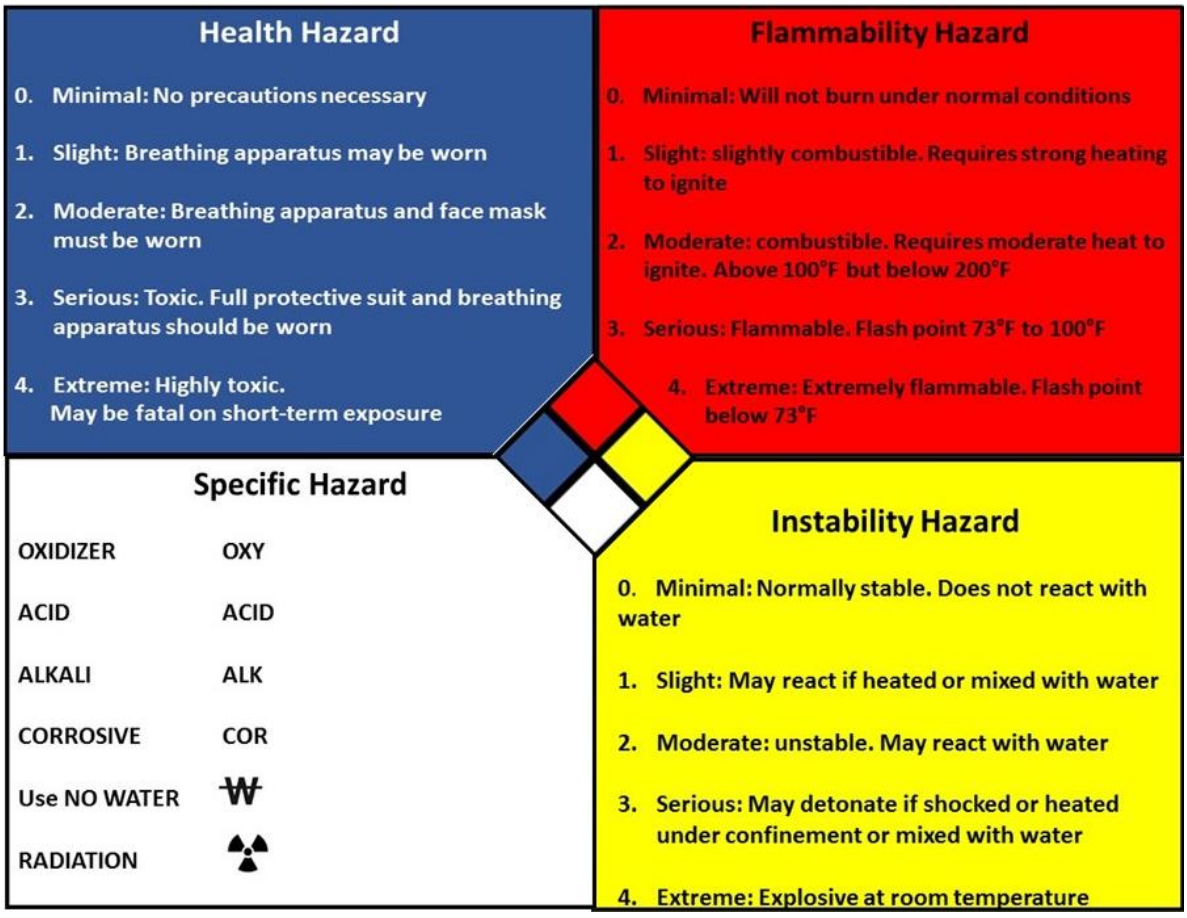
NFPA 704 Identification System

NFPA 704 provides a simple, readily recognized, easily understood system for identifying the specific hazards of a material and the severity of the hazard that would occur during an emergency response. The system addresses the health, flammability, instability, and special hazards presented from short-term, acute exposure that could occur as a result of a fire, spill, or similar emergency.

The system is characterized by the "diamond" shape. It identifies the hazards of a material and the degree of severity of the health, flammability, and instability hazards. Hazard severity is indicated by a numerical rating that ranges from zero (0) indicating a minimal hazard, to four (4) indicating a sever hazard. The hazards are arranged spatially as follows:

- Health at nine o'clock
- Flammability at twelve o'clock
- Instability at three o'clock
- Special hazards at six o'clock

In addition to the spatial orientation that can be used to distinguish the hazards, they are also color-coded as follows: blue for health, red for flammability, yellow for instability, and white for special hazards. The special hazards in use includes ~~W~~, OX, and SA. ~~W~~, indicates unusual reactivity with water and is a caution about the use of water in either firefighting or spill control response. OX, indicates that the material is an oxidizer. SA, indicates that the material is a simple asphyxiant gas (nitrogen, helium, neon, argon, krypton or xenon).



What information on the SDS should be used to rate hazardous materials?

The ratings can be determined by using the information found on a Safety Data Sheet (SDS) and comparing it to the criteria provided in NFPA 704. The following sections of the SDSs should be reviewed when determining the ratings:

- Health – Sections 2, 4, 8, 9, 11
- Flammability – Sections 2, 3, 9
- Instability – Sections 5, 7, 10
- Special Hazards – Sections 5, 9, 10, 11

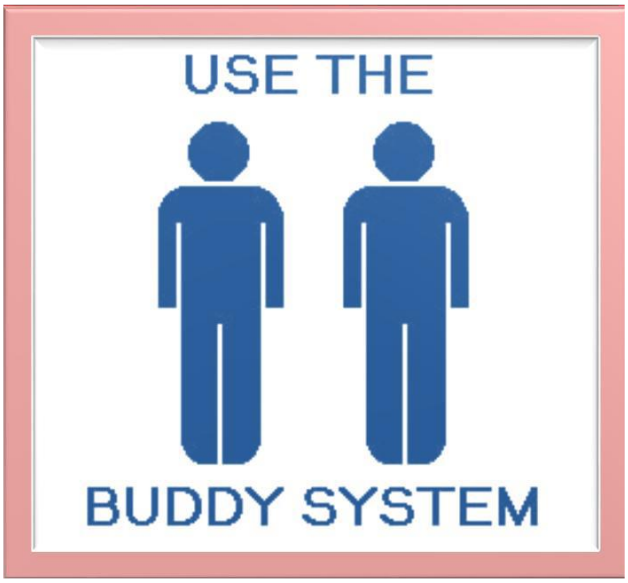
Caution!!! DO NOT use the hazard category numbers given in section 2 of SDSs as hazard ratings to be placed on 704 labels (*See Appendix A for more information*)

Spill Response Procedures

I. Introduction

The CMNBTR Laboratories uses many hazardous chemicals and the possibility of a major spill always exists. Therefore it is necessary to know how to react quickly and properly to any chemical spill to avoid injury, death or major equipment damage. A large acid spill, HF for instance, might cause serious injury or even death if handled improperly. These procedures are intended only to provide guidelines. Common sense should always be used when dealing with any chemical spill. Safe practices should be foremost in your mind whenever you are in any of the CMNBTR laboratories.

You should never work alone in the CMNBTR labs (BUDDY POLICY). TSU CMNBTR Laboratory policy dictates there must be at least one other person in the CMNBTR laboratory at all times.

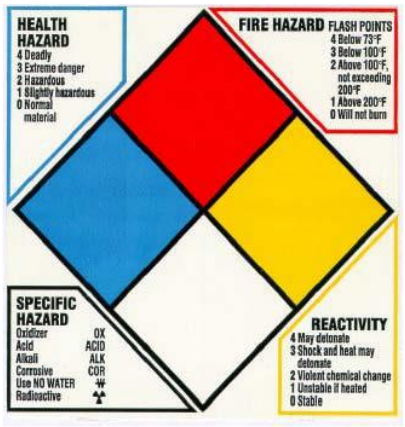


II. Spill Response Kit Items

The CMNBTR lab spill response kits are located under the sink in each lab. It is clearly marked as a spill response kit and contains the items you will need to combat a minor or major spill. **All spills must be reported to the Laboratory Staff, Principle Investigator and documented on the Incident Report Form.**

The items included in the CMNBTR Spill Response Kit are,

- Absorbent spill dam
- Absorbent pillows
- Acid neutralizer
- Caustic neutralizer
- HF ointment (calcium gluconate 2.5%)
- pH paper
- Two pairs of acid gloves
- Two pairs of vapor-resistant goggles
- Trash bags
- 5 gal. Haz-Mat bucket w/ NFPA labels



III. Spill Response Procedure

Properly clean up spills, using appropriate protective equipment and proper disposal procedures. Chemical spills are contained using the "Think C.L.E.A.N. Plan"

Contain the spill

Leave the area

Emergency: eye wash, shower, medical care etc.

Access Material safety Data Sheet (MSDS)

Notify supervisor

a. Cleanup of Known Chemical Spills

1. Did the chemical spill on you?

- If the chemical is a strong acid or base, remove contaminated clothing and run the affected area under water for 15 to 20 minutes. This should relieve some of the pain and reduce the danger of severe burns.
- If the chemical is HF, remove contaminated clothing and run the affected area under water for 15 to 20 minutes.
    - Apply a liberal amount of Calcium Gluconate gel to the area, following the directions on the package.
    - **Seek medical attention as soon as possible**.

More information on hydrofluoric acid first aid instructions can be found in the First Aid section below.

2. Is the chemical hazardous?

If the chemical is hazardous and you feel you cannot handle it, alert others to its presence and evacuate the laboratory. During the workday, notify the CMNBTR laboratory staff. If after hours, call the TSU Police @ 615.963.5171 first, and then notify the CMNBTR Laboratory staff at: 615.277.1668. If the chemical is a solvent or possesses a strong odor, evacuate the lab and put on a respirator and goggles before returning to clean up the spill.

3. Retrieve the spill response kit:

- If the chemical is acidic or basic, put on acid gloves, respirator and goggles before attempting to clean up the spill.
- Isolate the area around the spill.
- Select the proper equipment for the spill.
    - *For large spills*, those from a half gallon bottle or larger, an absorbent dam will be necessary to prevent spreading.

- *For small spills*, only absorbent pillows are necessary. Select the proper neutralizer for the chemical (note: solvents do not require a neutralizer).

4. Attack the spill:

- If using an absorbent dam, place the dam around the spill, approximately 4 inches from the liquid.
- Place the neutralizer bottle on the floor. Release the clamp and spray neutralizer, pushing the chemical into the spill dam. Be sure to cover the entire spill.
- *For strong acids* (HF and Sulfuric), use approximately an 8:1 ratio of neutralizer to chemical to completely neutralize the spill.
  - The acid neutralizer will turn from purple to yellow to red when finished.
  - Check pH, it should be around 7. If still acidic, continue adding neutralizer until pH=7.
- *For strong bases* (metal and ammonium hydroxides), you will need approximately a 6:1 ratio of neutralizer to chemical.
  - The base neutralizer will turn from red to blue to yellow when finished.
  - Check pH, it should be around 7. If still basic, continue adding neutralizer until pH=7.
- Once the reaction has ceased, allow liquid to cool. Check pH, it should be around 7. When cool, vacuum with the wet/dry vacuum cleaner.
- If dealing with a solvent spill, do not attempt to neutralize it. Soak up the chemical as soon as possible to avoid damage to the floor. Do not use water on the spill until after the entire chemical has been absorbed.

5. Clean up:

- Do not remove personal safety equipment until you have finished cleaning up. There may still be some active chemical on the floor.

- When the liquid has been completely absorbed, place the absorbent dam and pillows in double trash bags.
- If any glass is involved, place the glass in a separate Haz-Mat bucket and label it as “SHARPS” along with the chemical the glass contained.
    - Mechanical means, such as a brush and dustpan, tongs, or forceps should always be used to clean up broken glassware
- Wipe down the spill area with the mop and DI water. When finished, place the mop head in a fume hood sink and rinse it thoroughly with DI water.
- Place the bag in a Haz-Mat bucket and apply an NFR diamond label, writing the chemical on the label.
- Notify CMNBTR Staff.

b. Cleanup of Unknown Chemical Spills

Finding a chemical spill can be more dangerous than spilling the chemical yourself if the proper precautions are not taken. In most cases, the spill will be of a small amount of unknown chemical.

1. Assess any immediate hazards:

- Is there a strong odor? If so, evacuate the lab and put on a respirator before continuing.
- Is a violent reaction taking place? If so, it may be wise to wait until the reaction has finished.

2. Attempt to identify the chemical:

- Look for clues to the chemical’s identity: labels, tipped containers, etc.
- Wearing an acid glove, use the pH paper to identify whether the chemical is an acid, base or solvent and its strength.
- If the chemical can be classified as an acid or base with the pH paper but not identified, assume it is a very strong acid (HF) or a very strong base (Sodium Hydroxide).

3. *Is the chemical hazardous?*

- If the chemical is suspected of being hazardous and you feel you cannot handle it, alert others to its presence and evacuate the lab. During the workday, notify CMNBTR staff. After hours, call 615.963-5171 first and then notify CMNBTR staff.

4. *Retrieve the spill response cart*:

- Put on acid gloves and goggles before attempting to clean up the spill.
- Select the proper equipment for the spill.
    - For large spills, those from a half gallon bottle or larger, an absorbent dam will be necessary to prevent spreading.
    - For small spills, only absorbent pillows are necessary. Select the proper neutralizer for the chemical. (note: solvents do not require a neutralizer)

5. *Attack the spill:*

- If using an absorbent dam, place the dam around the spill, approximately 4 inches from the liquid.
- Place the neutralizer bottle on the ground. Release the clamp and spray neutralizer, pushing the chemical into the spill dam. Be sure to cover the entire spill.
- *For the strong acids* (HF and Sulfuric), use approximately an 8:1 ratio of neutralizer to chemical, to completely neutralize the spill.
    - The acid neutralizer will turn from purple to yellow to red when finished.
    - Check pH, it should be around 7. If still acidic, continue adding neutralizer until pH=7.
- *For strong bases* (metal and ammonium hydroxides), you will need approximately a 6:1 ratio of neutralizer to chemical.
    - The base neutralizer will turn from red to blue to yellow when finished.
    - Check pH, it should be around 7. If still basic, continue adding neutralizer until pH=7.

- Once the reaction has ceased, allow liquid to cool. Check pH, it should be around 7. When cool, vacuum with the wet/dry vacuum cleaner.
- If dealing with a solvent spill, do not attempt to neutralize it. Soak up the chemical as soon as possible to avoid damage to the floor. Do not use water on the spill until after the entire chemical has been absorbed.

6. Clean up:

- Do not remove personal safety equipment until you have finished cleaning up. There may still be some active chemical on the floor.
- When the liquid has been completely absorbed, place the absorbent dam and pillows in double trash bags.
- If any glass is involved, place the glass in a separate Haz-Mat bucket and label it as "SHARPS" along with the chemical the glass contained.
    - Mechanical means, such as a brush and dustpan, tongs, or forceps should always be used to clean up broken glassware
- Wipe down the spill area with the mop and DI water. When finished, place the mop head in a fume hood sink and rinse it thoroughly with DI water.
- Place the bag in a Haz-Mat bucket and apply an NFR diamond label, writing the chemical on the label.
- Notify CMNBTR Staff.

c. First Aid

First aid is an important element of CMNBTR Laboratory usage. The TSU CMNBTR Laboratory environment contains many potential hazards, especially the chemicals used. This section presents only a simplified first aid procedure for a hazardous chemical spill. For more specific information, consult the MSDS.

- ***Chemical Spill on Self***
    - If the chemical is a strong acid or base, run the affected area under water for 10 to 20 minutes. This should relieve some pain and reduce the danger of severe burns.

- If the chemical is HF, run the affected area under water for 15 to 20 minutes and then apply a liberal amount of calcium gluconate gel following the directions on the package. **Seek medical attention as soon as possible**.
- If the chemical is a solvent, rinse the affected area for 10-15 minutes to reduce any irritation.

- ***Chemical spill on Someone Else***
  - If the person is coherent, find out what chemical they were using.
  - If the person is unable to communicate, have someone place them under a safety shower and remove visibly contaminated clothing while attempting to identify the chemical:
    i. Look for clues to identify the chemical: labels, tipped containers, etc.
    ii. Wearing acid gloves, use a litmus paper to identify whether the chemical as acid, base or solvent and its strength.
  - If the chemical can be classified as an acid or base with the pH paper but not identified, assume it is HF or Sodium Hydroxide.
    i. Take necessary first aid action, including the use of HF ointment.
    ii. Notify Tennessee State University Police at 615.963-5171 as soon as possible and then notify CMNBTR laboratory staff.

- ***Hydrofluoric Acid First Aid Instruction***

Hydrofluoric acid (HF) is very corrosive, highly irritating and poisonous. HF burns can be severe and extremely painful, causing extensive damage to the skin and eyes, and to the mucous membranes if breathed or swallowed. HF is absorbed quickly and can cause widespread damage to the body and death. Any person contaminated with HF must have immediate first aid, followed by medical treatment from a physician as soon as possible.

HF FIRST AID PROCEDURES

Skin Exposure

1. Move the victim immediately under an emergency shower or other water source and flush the affected area with large amounts of cool running water. Immediately washing off the acid is of primary importance.
2. Remove all contaminated clothing while flushing with water.
3. While the victim is being rinsed with water, someone shall notify the lab manager (x1668) and arrange for emergency medical assistance (911 if a large area of exposure is involved, or for lesser injuries call the Student Health Services at 615.963.5291.
4. Immediately after flushing with water begin massaging the calcium gluconate gel into the burn site. Apply the gel every 15 minutes and massage until pain/redness resolve or until medical care is available. Wear gloves when applying the gel to prevent transfer of HF and secondary burns.

Eye Exposure

1. Immediately flush eyes for at least 15 minutes with copious cool flowing water.
2. If only one eye is affected, be careful not to flush contaminated water into the other eye.
3. Take the victim to a physician immediately and apply ice water compresses during transport.

Inhalation

1. Ensure the victim's clothing or skin has not been contaminated by HF, before removing him to fresh air.
2. If breathing has stopped, begin artificial respiration.
3. Call 911 for immediate medical assistance.

Swallowing

1. Rinse the mouth with cold water. **Do not induce vomiting**.

2. If the victim is conscious, have them drink lots of water to dilute the acid followed by a glass of milk or milk of magnesia.
3. Call 911 for immediate medical assistance.

REMEMBER, ALL PERSONNEL IN THE LAB, NOT ONLY THOSE WORKING WITH HF, SHOULD KNOW WHERE THE FIRST AID EQUIPMENT IS KEPT AND HOW TO CARRY OUT THE FIRST AID PROCEDURES FOR AN HF EXPOSURE OR BURN.

Hazardous Waste Guidelines

What is a Hazardous Chemical Waste?

- Federal and State regulations define hazardous waste as a substance that poses a hazard to human health or the environment when improperly managed. A chemical waste is considered hazardous if it is either listed on one of the lists of hazardous wastes found in the Federal or State regulations, or exhibits one or more of the four characteristics listed below.
- Check the **Hazardous Waste Chemical List *(located in the MSDS folder)***.
    - If your waste is on this list, treat it as a hazardous chemical waste.
    - If your waste is not on the list, determine if it meets any of the four characteristics listed below.
    - If your waste meets any of the four characteristics, it is a hazardous chemical waste.
- Hazardous chemicals that are stored in containers that are unlabeled or mislabeled, in poor condition, or abandoned are also considered hazardous waste.
- Used lubricating oil must be managed as a hazardous waste.
- Engineered nanomaterials such as nanotubes, nanorods, nanowires, quantum dots, etc. must be managed as a hazardous waste.

Characteristics of Hazardous Chemical Waste:

- ***Ignitable***
    - Flashpoint <140 degrees F
    - Capable of causing fire at standard temperature and pressure through friction, absorption of moisture, or spontaneous chemical changes
    - Is an ignitable compressed gas
    - Is an oxidizer

- ***Corrosive***

- Liquid with pH less than or equal to 2 or greater than or equal to 12.5
- Solid that has pH less than or equal to 2 or greater than or equal to 12.5 when mixed with equal weight of water

- ***Reactivity***
  - Normally unstable and readily undergoes violent change
  - Reacts violently with water
  - Forms potentially explosive mixtures with water
  - Forms toxic gases, vapors, or fumes when mixed with water
  - Is a cyanide or sulfide bearing waste which, when exposed to pH conditions between 2 and 12.5, can generate toxic gases, vapors, or fumes
  - Is capable of detonation or explosive decomposition if subjected to a strong initiating source or heated under confinement
  - Is readily capable of detonation or reaction at standard temperature and pressure

- ***Toxicity***
  - Has an acute oral LD50 less than 2,500 mg/kg
  - Has an acute dermal LD50 less than 4,300 mg/kg
  - Has an acute inhalation LC50 less than 10,000 ppm as a gas or vapor
  - Has an acute aquatic 96-hour LC50 less than 500 mg/l
  - Has been shown through experience or testing to pose a hazard to human health or environment because of its carcinogenicity (carcinogen, mutagen, teratogen), acute toxicity, chronic toxicity, bio-accumulative properties, or persistence in the environment

Hazardous Waste Labeling:

- Hazardous waste labels must be complete, legible, and permanent.
- Hazardous waste labels must be placed on the hazardous waste container upon the start of accumulation.

- Hazardous waste labels are located in the CMNBTR laboratory.

Hazardous Waste Segregation:

- All hazardous waste must be segregated to prevent incompatible mixtures.
- Segregation can be by hazard class. Hazard class examples include:
  - Flammable, Oxidizer, Pyrophoric, Reactive, Reducer, Acid, Base, and Toxic
- For more information on specific chemical incompatibility, consult a material safety data sheet (MSDS).

Hazardous Waste Storage:

- Hazardous waste containers must be stored in secondary containment to adequately contain all of the contents of the container.
- Hazardous waste containers must be kept closed, except when adding waste.
- Report damaged containers to EH&S. EH&S can provide assistance to transfer the contents of the damaged container to an appropriate container.
- Containers must be inspected weekly for signs of leaks, corrosion, or deterioration.
- Do not dispose of chemicals by pouring them down the drain or placing them in the trash.
- Do not use fume hoods to evaporate chemicals.

Sewer Disposal Guidelines

Only substances that meet all of the following criteria are allowed down the sanitary sewer drain:

Non-hazardous
- No radioactive waste
- No hazardous chemical waste
- No untreated biomedical waste

1. **Liquid**
   - No solids, sludge, or viscous substances

2. **Will not interfere with sewage treatment operations**
   - No corrosive pH levels
   - No grease or oil

Biomedical Waste Guidelines

Biomedical Wastes Are:

- Human or animal specimen cultures from medical/pathology labs.
- Cultures and stocks of infectious agents from research and industrial laboratories.
- Wastes from the production or testing of bacteria, viruses, spores and vaccines, certain discarded animal vaccines, and culture dishes and devices used to transfer, inoculate and mix cultures.
- Human or animal specimens, tissues, parts, fluids, or carcasses that are suspected of being contaminated with infectious agents known to be contagious to humans.
- Waste which contains recognizable fluid blood, fluid blood products, containers or equipment containing blood that is fluid, or blood from animals known to be infected with diseases which are highly communicable to humans.
- Discarded materials contaminated with excretion, exudate or secretions from humans or animals that are contaminated with highly communicable diseases or diseases of animals that are highly communicable to humans.
- Waste pharmaceuticals not regulated by EPA as RCRA hazardous wastes or controlled substances.

Wastes that are mentioned above or sharps waste AND generated or produced from:

- Diagnosis, treatment or immunization of human beings or animals.
- Research pertaining to the above activities.
- The production or testing of biologicals (medicinal preparations made from living organisms and their products, including but not limited to, serums, vaccines, antigens and antitoxins).
- The accumulation of properly contained home-generated sharps waste that is brought by a patient, etc.

- Urine, feces, saliva, sputum, nasal secretions, sweat, tears, or vomitus that contains fluid blood.

Biomedical Waste Labeling:

- All biomedical waste containers including red bags, bottles, sharps containers and secondary containers must be labeled with the words “BIOHAZARDOUS WASTE” or with the international symbol and the word “BIOHAZARD”.

Biomedical Waste Storage:

- All biomedical waste must be contained separately from other waste at the point of generation.
- All solid biomedical waste must be placed in red bags, securely tied and placed in secondary containment.
- Secondary containers must be rigid, leak resistant, have tight fitting covers, be clean, and in good repair.
- All biomedical sharps waste must be placed in an approved biohazardous sharps container that is rigid puncture-resistant and which, when sealed, is leak resistant and cannot be opened without great difficulty.
- All solid biomedical waste, except for biomedical sharps waste, must be transferred to EH&S within 7 calendar days of being generated.
- Biomedical sharps waste must be transferred to EH&S within 7 calendar days of being approximately 2/3 full.

Liquid Biomedical Waste Disposal:

1. Mix 1 part household bleach to 9 parts liquid biomedical waste.
2. Wait 30 minutes.
3. Pour down sanitary sewer drain.

Sharps Biomedical Waste Disposal

- All biomedical sharps must be disposed in biohazardous sharps containers.
- These containers should not be emptied

Radioactive Waste Guidelines

Radioactive Waste Segregation

STEP 1

Segregate radioisotopes by waste type

- ✓ ***Solid Waste:*** lab debris (paper, etc.), disposable gloves, etc.
- ✓ ***Non-hazardous Liquid Waste:*** buffers, aqueous liquids with a pH between 7 and 11
- ✓ ***Hazardous Liquid Waste:*** flammable, corrosive, toxic, etc.
- ✓ ***Liquid Scintillation Cocktail:*** vials containing scintillation cocktail
- ✓ ***Sharps:*** needles, razor blades
- ✓ ***Bio-hazardous Waste:*** animal carcasses or tissue
- ✓ ***Lead:*** bricks, foil, etc.

STEP 2

Within each waste type, segregate radioisotopes by half-life:

- ✓ < 15 days (such as 32P and 111In)
- ✓ 15-28 days (such as 33P and 51Cr)
- ✓ 29-60 days (such as 59Fe and 125I)
- ✓ 61-90 days (such as 35S)
- ✓ 90 days (such as 3H, 14C, 57Co, 22Na, 45Ca)

Radioactive Waste Labeling and Storage

- Use appropriate label and containers for labeling and storage of radioactive waste
- Always place liquid container in secondary containment to adequately contain all of the contents of the container/spilled materials
- Mark storage area with “Caution Radioactive Material” sign that include the trefoil radiation symbol
- Keep containers closed when not in use.

- **Do nor dump it down the drain!**
- **Do not dispose of radioactive materials/waste via sinks or trashcans.**
- **Do not intentionally evaporate radioactive materials/waste**

Please make sure you read and understand the Tennessee State University Radiation Safety Manual and have completed the Radiation Safety training ***BEFORE*** *you start working with radioactive materials.*

Material	Can it go down the sanitary sewer drain?	Waste Management
Biomedical Waste	Liquids: No, unless it has been decontaminated Solids: No	Liquid biomedical waste can be decontaminated and made suitable for sanitary sewer drain disposal by: 1. Mixing 1 part household bleach to 9 parts liquid biomedical waste 2. Wait 30 minutes 3. Pouring down sanitary sewer drain For solid biomedical waste disposal please refer to the ***TSU Biosafety Manual***
Radioactive Waste	NO	For radioactive waste disposal information please refer to the ***TSU Radiation Safety Manual***
Hazardous Chemical Waste	NO	For hazardous chemical waste disposal information please refer to the ***TSU Laboratory Hygiene Plan***
Non-Liquids	**Can it go down the sanitary sewer drain?**	**Waste Management**
Solids, sludge, or viscous substances	NO	These items can obstruct the flow of sewage. For hazardous chemicals waste disposal information please refer to the ***TSU Laboratory Hygiene Plan*** Place non-hazardous solids, sludge, or viscous substances in the regular trash
Powders and salts	NO	These items can obstruct the flow of sewage. For hazardous chemicals waste disposal information please refer to the ***TSU Laboratory Hygiene Plan*** Place non-hazardous powders and salts in the regular trash
Corrosive pH Levels	**Can it go down the sanitary sewer drain?**	**Waste Management**
Corrosive waste with a pH	No, unless the pH has been adjusted and there are no	You have 2 disposal options:

between 2.0 and 5.0	other hazardous constituents.	1. Adjust the pH to greater than 5.0 and less than 12.5 and then dispose of it down the drain 2. Store and dispose of non-adjusted waste as a hazardous chemical waste
Corrosive waste with a pH between 2.0 or lower or pH of 12.5 or higher	NO	This type of waste is always considered hazardous chemical waste. • Do not adjust the pH • Store and dispose of waste as a hazardous chemical waste
Grease and Oil	**Can it go down the sanitary sewer drain?**	**Waste Management**
Grease and Oil	NO, unless the concentration is less than 100mg per liter	For higher concentration: • Dispose of lubricating oils such as automotive oil, gear oil, and machinery grease as a hazardous chemical waste **Dilution of higher concentrations is illegal and not allowed** • Place food oils such as vegetable oil, lard, or shortening in the regular trash or in a food oil recycling container
Common Questions	**Can it go down the sanitary sewer drain?**	**Waste Management**
Ethanol	NO, unless the concentration is non-hazardous	Ethanol is non-hazardous in concentrations less than 24% **Dilution of higher concentrations of any alcohol including ethanol is illegal and not allowed**
Ethidium Bromide Electrophoresis buffers	NO, unless it has been filtered through a bed of active charcoal	Prior to sanitary sewer drain disposal of the filtered non-hazardous solution, check for fluorescence by using a UV light to ensure complete removal of the ethidium bromide.

		For more information please refer to the Ethidium Bromide Treatment and Disposal Guidelines in Appendix A
Hydrogen Peroxide	NO, unless its concentration is less than 8%	**Dilution of higher concentrations is illegal and not allowed** Dispose of higher concentrations as a hazardous chemical waste
Photo and X-Ray Processor Chemicals	NO	Disposal of photo and X-ray processor chemicals as a hazardous chemical waste
Latex paint	NO	Liquid latex paint cannot be disposed of in the regular trash, poured down sanitary sewer, storm drain, or dumped on the ground. • Dispose of liquid latex paint as a hazardous chemical waste. • Place solid latex paint in the regular trash.
Oil Based Paint	NO	Dispose of oil based paint as a hazardous chemical waste.
Trace Metals, Persistent and bioaccumulative Toxic Compounds	NO, unless the concentration is below the threshold limits (*listed in Appendix A)* and there are no other hazardous constituents.	**Dilution of higher concentrations is illegal and not allowed.** Dispose of higher concentrations as a hazardous chemical waste.
Other Chemicals	NO, unless the concentration is nonhazardous.	Some chemicals are hazardous in any concentration. **Dilution of chemicals is illegal and not allowed**. For chemical waste disposal information please refer to the TSU Hazardous Chemical Waste Guidelines (Pg. 25)

Tennessee State University
Hazardous Waste Emergency Contingency Plan

Tennessee State University is committed to ensuring the safety of its employees, students and visitors on campus in all facets of daily operations and activities. EPA and TDEC regulations require hazardous waste generators to have knowledge of and implement, as necessary, emergency procedures in the event of a chemical spill or release. Therefore, whenever there is a spill or other emergency involving materials or hazardous wastes that present a danger to human health or life or to the environment, the following instructions must be followed by all employees, staff and faculty:

1. Where highly flammable liquids or gases are released, or there is danger of explosion, follow campus fire emergency procedures:
    a. If possible, contain the spill and close doors to the area.
    b. Activate the fire alarm.
    c. Evacuate the area and building. Do not use elevators.
    d. Call TSU Police at 5171. TSU Police will contact emergency response services.
    e. Contact the Campus Office of Environmental Health and Safety at 5683 or 5202.
    f. Remain outside the building until given the all clear by emergency response personnel.

2. Without jeopardizing personal safety, injured personnel should be removed from the site of the emergency.

3. Small Spills that do not involve an injury or present a fire or explosion hazard may be cleaned up by properly trained and equipped laboratory or shop personnel. Clean-up materials shall be discarded as hazardous waste into appropriate waste containers. Each laboratory or shop should have an appropriate chemical spill clean-up kit.

4. For larger spills or releases:

a. If possible, contain the spill and close doors to the area.
b. Access the MSDS sheet for the chemical.
c. The area of the spill must be evacuated and secured. The evacuation area may range from the area immediately adjacent to the spill or release, the laboratory, shop, floor, or entire building, or even larger areas depending upon the nature and quantity of the hazardous chemical released.
d. If the chemical has come into contact with a person, follow the MSDS recommendations for first aid.
e. Contact TSU Police at 5171. TSU Police will contact emergency response services. Be prepared to give as much data about the chemical spill as possible: type of hazard, type of container, amount spilled, from what size of container, further leaks, where spill is moving, what has been done to contain it, type and number of any injuries, etc.
f. Notify supervisor, principal investigator, laboratory safety officer, department heads, deans, and other pertinent personnel.
g. Contact the Campus Office of Environmental Health and Safety at 5683 or 5202.
h. Do not re-enter the building until given the all clear by emergency response personnel.

5. Clean up of larger spills or releases:

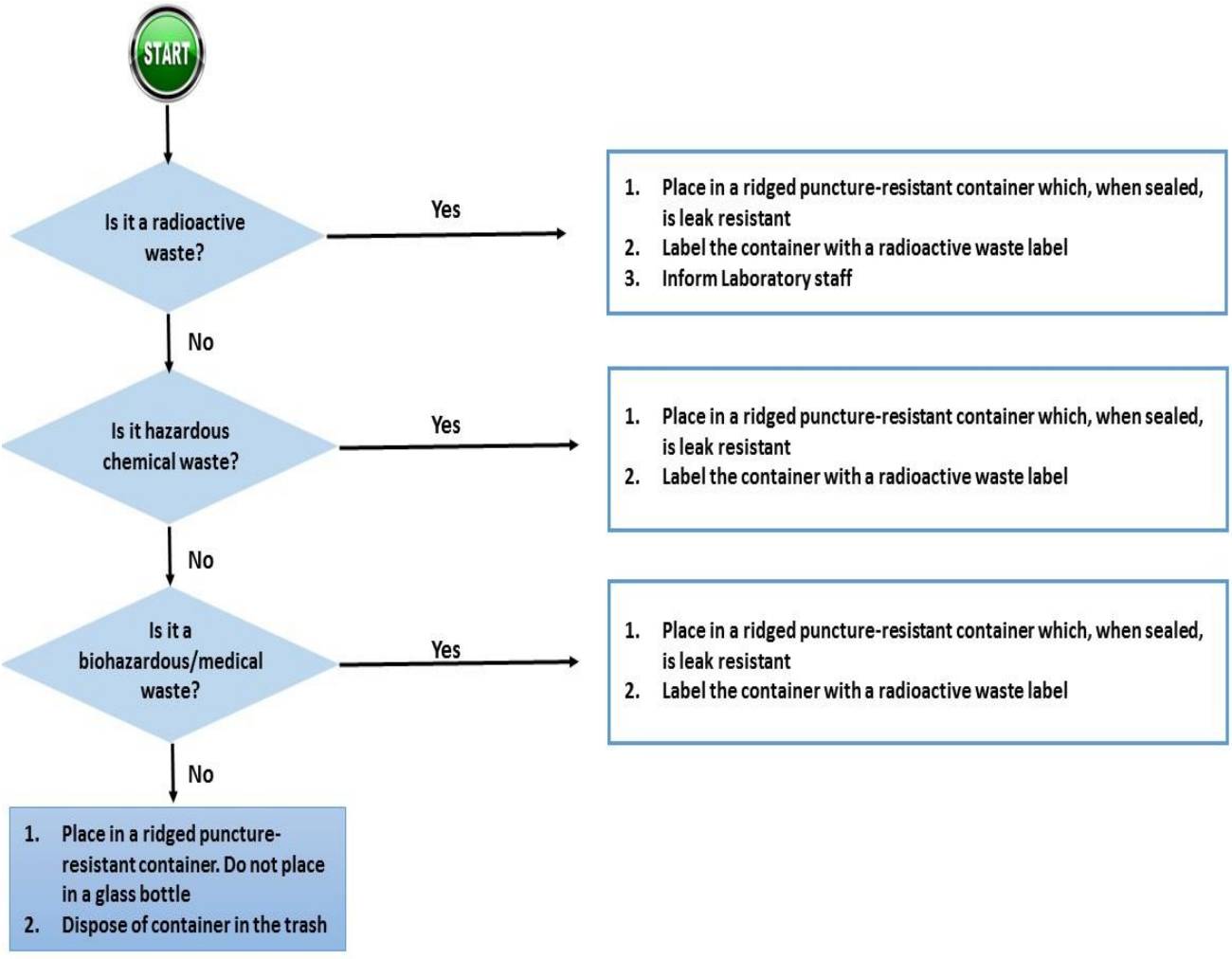
Call and consult with the Campus Office of Environmental Health and Safety. The Tennessee Board of Regents has a contract with Environmental Program Consultants for clean-up response 24 hours a day, 7 days a week.

They may be reached by calling this number:

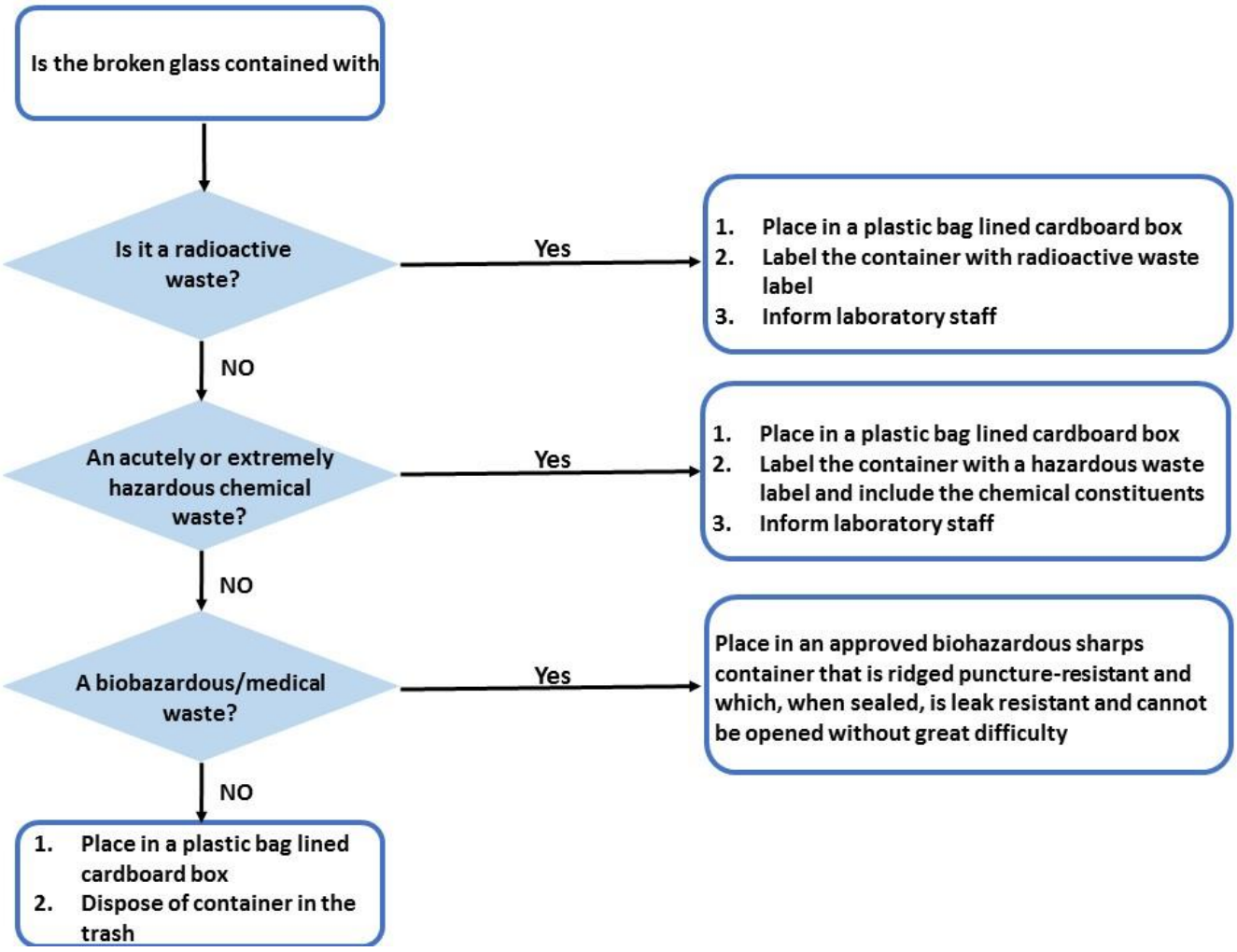
1-888-838-1255

Sharps Waste Guidelines

Sharps are any device having acute rigid corners, edges or protuberances capable of cutting or piercing skin or regular waste bags. Some examples include needles, razors, scalpel blades, broken glass and plastic, Pasteur pipettes, pipettes, pipette tips, capillary tubes, microscope slides and other sharp-cornered objects. Follow the flowchart to appropriately manage your sharps waste.



Broken Glass Guidelines



A list of acutely or extremely hazardous waste can be found in the back of the MSDS binders located in all CMNBTR laboratories.

At no time should hazardous materials/waste containers be placed in the trash.

CMNBTR Laboratory Rules

The following describes proper laboratory policies users must follow at all times. Failure to do so is a violation, and the penalties for the violations are listed below.

1. Unlawful use of any CMNBTR laboratory equipment without authorization

Every user operating any equipment must be authorized to use that equipment. In order to obtain authorization, a user is required to go through the general CMNBTR Laboratory Policies and Procedures Plan training and testing on the equipment and subsequent equipment check off.

Training sessions are held per need basis. More information is available from the laboratory Manager or the Tool Owner.

Once trained by an experienced user of the equipment, one should then schedule time with a trainer to obtain a check off after a minimum of one week from the training. Doing so gives one time to get ready for check off. Also, if there are other users who are currently authorized to use that particular equipment, you can operate the machine under the constant supervision of the users.

When a student is ready for a check off, the trainer and trainee must meet for a check-off session. The trainee must demonstrate his/her ability to use the equipment without any assistance. If the trainer deems the user capable of using the equipment without causing any damage, he/she will grant access to the user, thereby making him/her an authorized user of the equipment. From this point on, the user can use the equipment without supervision. In cases where the trainer decides against granting access to the user, the trainer and trainee need to schedule another check off session.

Penalty: Suspension from all CMNBTR Laboratories

2. Granting access to an unauthorized user to use Equipment

No user can grant access to an unauthorized user to use any equipment without the user's constant supervision.

Authorized users are allowed to train other users on the equipment. They are responsible for any damage to the equipment caused by the trainee, as it will be regarded as an act of negligence of the authorized user.

Penalty: Suspension from all CMNBTR Laboratories.

3. USING EQUIPMENT WITHOUT BEING AN AUTHORIZED USER AND/OR NOT UNDER SUPERVISION.

A user is not allowed to use equipment without being an authorized user for the equipment (see Violation 1). He/she can only use the equipment under the full supervision of an authorized user or Tool Owner/Principal Investigator (see Violation 2)

Penalty: Suspension from all CMNBTR Laboratories.

4. ALLOWING AN AUTHORIZED/UNAUTHORIZED USER TO USE EQUIPMENT UNDER YOUR NAME (I.E. USING YOUR LOGIN INFORMATION) WITHOUT SUPERVISION.

No user can grant access to another user, authorized or unauthorized, to use equipment without constant supervision. The authorized user who has login access to the equipment must be present at the equipment the entire time the other user is using the equipment.

The authorized user is allowed to train the other user on the equipment. The user whose login is being used is responsible for any damage to the equipment caused by the other user, as it will be regarded as an act of negligence of the cardholder.

Penalty: Suspension from all CMNBTR Laboratories

5. USING EQUIPMENT RESERVED FOR ANOTHER USER.

- A user is not allowed to sign in on equipment reserved by another user for the first 15 minutes of the first hour the equipment is reserved. If the person, who reserved it, does not show up in 15 minutes, any authorized user can use the machine after that time.
- If a user's run exceeds his/her scheduled time, the next user who has reserved the equipment should reach a compromise with the previous user. The equipment belongs to the user who reserved it and it is entirely his/her decision to allow or disallow the previous user to continue using the equipment from using it.
- The user should be careful in allowing the previous user to continue using the equipment, as he/she face the risk of violating a laboratory policy (see Violation 7). Also, after 15 minutes is up, if another user finds the equipment not in use and begins using it, the machine belongs to this user. Therefore, if a user allows the previous user to continue, he/she must sign into the equipment after logging out the other user. The user then be around the equipment to prevent Violation 4

Penalty: **Suspension from all CMNBTR Laboratories for 3 weeks**

6. USING EQUIPMENT WHEN IT IS UNDERGOING MAINTENANCE AND IS MARKED NOT TO BE USED OR "OUT OF SERVICE"

Under no circumstances is a user allowed to perform any maintenance on any equipment. Any abnormalities while using the equipment must be reported promptly.

When a machine is undergoing maintenance/repairs, users must be cooperative and patient. No user is allowed to use equipment that is in a non-working condition or when it is going routine maintenance.

Penalty: **Suspension from the all CMNBTR Laboratories for three weeks.**

7. BEING LOGGED IN THE EQUIPMENT FOR LONGER THAN THE EQUIPMENT TIME LIMIT.

All the equipment in the CMNBTR labs have a time limit, which is the maximum number of hours the equipment can be used in one session. No user should be logged in any equipment exceeding this time limit. This is to ensure others have the opportunity to use the equipment.

If the equipment is not reserved by another user, it can be continued to be used. If the equipment time limit for usage is exceeded, skip the log out and log back in. This resets the timer for equipment log in.

Penalty: **First Offense: Written warning.**

Second Offense: One week suspension from all CMNBTR Laboratories.

Third and Subsequent Offenses: One week suspension from all CMNBTR Laboratories each time.

8. Failure to log in at the computer or Log Book.

All users must log in at the computer. If for any reason, the computer is not working, you have to report in the Log Book next to the computer.

From the moment you enter the Cleanroom until you are no longer using any equipment, you must remain logged in. If you are leaving the Cleanroom, but are still using the equipment, you should not log out.

Penalty: First Offense: Written warning.

Second Offense: One week suspension from all CMNBTR Laboratories. Third and subsequent Offenses: One week suspension from all CMNBTR Laboratories each time.

9. Failure to log out from the computer or the log book.

All users must log out at the computer when leaving the CMNBTR labs provided they are not still using equipment. Use the Log Book if the computer is not working.

From entering the CMNBTR labs until exiting, users must remain logged in the computer. If leaving the CMNBTR labs but are still using equipment inside the cleanroom, do not log out. Only after using the equipment, should a user log out.

Penalty: First Offense: Written Warning.

Second offense: One week suspension from all CMNBTR laboratories. Third and subsequent Offenses: One week suspension from all CMNBTR laboratories each time.

10. LEAVING CHEMICALS WITHOUT PROPER DOCUMENTATION ON CHEMICAL SAFETY WARNING SHEETS.

Chemical Safety Warning Sheets are available in the all and must be completed by providing all the information required on the form.

All chemicals left unattended must be properly documented by the use of the Chemical Safety Warning forms.

Penalty: a) The mislabeled chemical will be disposed of

b) The student will be issued with a written warning

c) Repeat Offenders – One week suspension from the all CMNBTR laboratories each time.

11. NOT WEARING PROPER SAFETY EQUIPMENT AT THE HOOD.

- Personal Protective Equipment must always be used when handling chemicals at the Fume Hood and other situations where there is risk of injury or health effects.
- Required basic CMNBTR lab garment consists of a lab coat and gloves.
- In addition, when dealing with chemicals, a face shield and an acid apron must be worn at the fume hood.
- When handling acids, acid Gloves should also be worn.

Penalty: *First Offense*: Reminder to put on proper safety equipment.

***Second offense*: Written warning.**

***Third Offense*: One week suspension from all CMNBTR laboratories each time.**

Fourth Offense: **One month suspension from all CMNBTR laboratories each time**

Subsequent *Offenses*: One semester suspension from all CMNBTR laboratories each time

12. NOT PARTICIPATING IN CLEAN-UP.

Cleanup will be held every Friday and the scheduled time is 2pm. However, a user can perform their duties any time before Friday when scheduled for cleanup.

It is preferable to reschedule before the next specified time. Only in emergency situations will a cleanup be rescheduled.

Penalty: Account privileges will be suspended

13. UNAUTHORIZED ENTRY INTO CMNBTR LABORATORIES BY FOLLOWING ANOTHER USER

Each user should use their ID card to enter into the CMNBTR laboratories

Penalty: Suspension from all CMNBTR laboratories for three weeks.

14. ALLOWING A USER TO ENTER BEHIND YOU WHEN THEY DO NOT SWIPE THEIR CARD

Be careful that no one follows you into the CMNBTR labs without swiping his/her card. Each user must swipe their card to enter the CMNBTR labs. No one should follow another user into the labs. This is to prevent unauthorized users into the CMNBTR labs.

Penalty: Suspension from all CMNBTR laboratories for three weeks.

15. DAMAGE TO THE EQUIPMENT

Damages resulting from a user's negligence are the user's responsibility, and cost of repair/replace. The charges that the individual can pay as a result of their negligence will vary by case.

Penalty: Users are responsible for damages to machines that are a result of negligence.

16. Not following proper PPE procedures

Normal CMNBTR laboratory attire consists of a lab coat and gloves.

NOTE: Safety glasses/goggles are MANDATORY when handling chemicals and glass.

Penalty: ***First Offense*: Reminder of proper lab attire.**

***Second Offense*: Written warning.**

***Subsequent Offenses*: One week suspension from all CMNBTR laboratories for each offense thereafter.**

17. Removing supplies and/or equipment from the CMNBTR Laboratories

All supplies in the CMNBTR laboratories, such as the solvent squirt bottles, tote boxes and hot plates are for CMNBTR laboratory use **ONLY**. These supplies and equipment are for CMNBTR laboratory related research only.

Nothing should be removed from the CMNBTR labs for use by other laboratory or department. The lack of supplies and equipment hinders other users from making progress in their research.

Penalty: Suspension from the all CMNBTR laboratories for three weeks.

18. Changing the equipment settings

The computers attached to any equipment are exclusively for equipment use only. They are to be used for applications only.

No additional software should be installed in any equipment as this violates equipment warranty.

No one should modify any software setting in any system as this often leads to equipment malfunction.

Penalty: Suspension from all CMNBTR laboratories for three weeks.

The intent of these policies and procedures is to ensure an environment where researchers can work together safely and productively while maintaining the integrity of all CMNBTR Laboratory environment and equipment. These policies and procedures will certainly change with time as the personality of our laboratories becomes more clearly understood. Users are strongly encouraged to make suggestions on how we can more effectively meet our goals.

APPENDIX A

Frequently Asked Questions on NFPA 704

Standard System for the Identification of the Hazards of Materials for Emergency Response

1. What is NFPA 704?

NFPA 704 provides a simple, readily recognized, easily understood system for identifying the specific hazards of a material and the severity of the hazard that would occur during an emergency response. The system addresses the health, flammability, instability, and special hazards presented from short-term, acute exposures that could occur as a result of a fire, spill, or similar emergency.

2. How does the 704 label differ from other hazardous material labels?

There are several widely used systems for labeling hazardous materials. Each has a specific purpose and it is important to recognize the differences between each. Table 1 provides a brief summary of the purpose and use of three common labeling systems used for hazardous materials. Note that you may see more than one label on a container depending on the situation. *(See Question 11 for additional information on the differences between OSHA HazCom 2012 classifications and NFPA 704 ratings)*

Label Type	Purpose	Typical Label Location	Label Example
NFPA 704 Diamond www.nfpa.org/704	Provides information about hazards that occur during emergency response	Outside buildings, on doors, on tanks, visible to emergency responders during spill or fire	
DOT Placard www.dot.gov/	Provides information about hazards to transportation workers and emergency responders	Tank cars, cargo tanks, portable tanks, bulk packages, vehicles or containers containing non-bulk packages	
OSHA HazCom 2012 www.osha.gov/	Provides information about hazards to workers using chemicals under normal conditions of use	Pipes, drums, and containers of materials that are used in the workplace	

Table 1. NFPA, DOT and OSHA Placard and Pictograms

3. When am I required to use the NFPA 704 rating system?

NFPA 704 labels are required when another Federal, state or local regulation or code requires their use. NFPA 704 does not specify when a container, tank or facility must label with the 704 diamond. It tells you HOW to label when another code, standard or an AHJ (Authority Having Jurisdiction, such as the local fire department) requires such labeling.

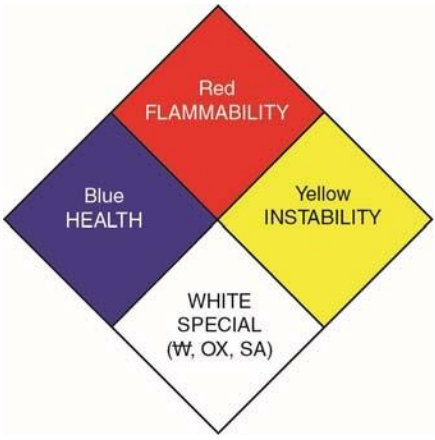
Some of the more widely adopted and used NFPA codes that require 704 labels for specific occupancies, storage, and hazardous materials, include:
NFPA 1, Fire Code
NFPA 30, Flammable and Combustible Liquids Code
NFPA 45, Standard on Fire Protection for Laboratories Using Chemicals
NFPA 55, Compressed Gases and Cryogenic Fluids Codes
NFPA 400, Hazardous Materials Code

In addition, some facilities choose to utilize the NFPA 704 placards regardless of actual requirements in order to provide additional information on the hazards of the materials on site.

4. Why should I use the NFPA 704 rating system?

NFPA 704 labels provide an appropriate signal or alert for the protection of emergency response personnel, assist in planning for effective fire and emergency control operations, including cleanup. It can also assist all designated personnel, engineers, plant, and safety personnel in taking inventory and evaluating the relative hazards of materials in their facility.

5. How is the rating displayed?



The system is characterized by the "diamond" that is actually a "squareon-point" shape. It identifies the hazards of a material and the degree of severity of the health, flammability, and instability hazards. Hazard severity is indicated by a numerical rating that ranges from zero (0) indicating a minimal hazard, to four (4) indicating a severe hazard. The hazards are arranged spatially as follows: health at nine o'clock position, flammability at twelve o'clock position, and instability at three o'clock position. In addition to the spatial orientation that can be used to distinguish the hazards, they are also color-coded as follows: blue for health, red for flammability, and yellow for instability. The shades of red, blue and yellow are not regulated, but should be contrasting colors. The hazard ratings may have colored backgrounds with contrasting colored
numerals or colored numerals with a white background.
(See Section 4.1.5 and Figure 9.1(a) of NFPA 704)

The six o'clock position on the symbol represents special hazards and has a white background. The special hazards in use include W, OX and SA. W, indicates unusual reactivity with water and is a caution about the use of water in either firefighting or spill control response. OX, indicates that the

material is an oxidizer. SA, indicates that the material is a simple asphyxiant gas (nitrogen, helium, neon, argon, krypton or xenon.) *(See 8.2.1 through 8.2.4 of NFPA 704)*

5. What other symbols can go in the special hazards quadrant of the "diamond"?

The only authorized symbols are the ~~W~~, OX, and SA symbols described above. The number of symbols is kept to a minimum for emergency visibility and simplicity reasons. Many people ask about placing additional symbols such as "corr" for corrosive or "acid" for acids, but these hazards are already taken into account in the health rating that is located in the blue section of the symbol.

6. Who provides NFPA 704 ratings and can I find those ratings in the Standard?

While the system is simple in application, the hazard evaluation should be performed by persons who are technically competent and experienced in the interpretation of the hazard criteria as set forth in Chapters 5-8 of the NFPA 704 standard. A qualified individual can determine the ratings for a material by comparing data from the manufacturer-supplied safety data sheets (SDSs) to the criteria located in NFPA 704. Though it is not required, some SDSs include the NFPA 704 diamond symbol with ratings, and some SDS provide the NFPA 704 rating numbers within text of the SDS. *(See Question 7)*

While the criteria are located in NFPA 704, the actual ratings for specific chemicals are not included in the document. The NFPA Fire Protection Guide to Hazardous Materials includes two withdrawn NFPA documents that contain hazard property information based on previous editions of NFPA 704 and include NFPA ratings for numerous chemicals. This information can be used for guidance, however ultimately the user is responsible for rating materials using the SDS and the criteria located in the latest edition of NFPA 704.

7. What information on the SDS do I use to rate my hazardous materials?

The ratings can be determined by using the information found on a HazCom 2012 compliant Safety Data Sheet (SDS) and comparing it to the criteria provided in NFPA 704. The following sections of the SDSs should be reviewed when determining the ratings:

Health – Sections 2, 4, 8, 9, 11
Flammability – Sections 2, 3, 9
Instability – Sections 5, 7, 10
Special Hazards – Sections 5, 9, 10, 11

Caution!! Do NOT use the hazard category numbers given in section 2 of HazCom 2012 compliant SDSs as hazard ratings to be placed on 704 labels! *(See Question 11 for additional information).*

8. Where should I post the NFPA 704 placards at my facility and how many placards should I use?

It is important to note that the placard is meant to provide quick hazard information for emergency responders. It should be visible in case of an emergency where the responders are likely to enter. If there are numerous areas where the responders could enter the facility, there should be numerous placards. The placement and quantity should be decided using a facility's best judgment coupled with the advice from your Authority Having Jurisdiction. At a minimum the placard should be posted on the two exterior walls of a facility or building, each access to a room or area, or each principal means of access to an exterior storage area. Section 4.3 of NFPA 704 provides guidance on locations for posting.

9. What size placard is required for NFPA 70?

The size of the placard is dependent on the distance at which the hazard ratings must be legible. Chapter 9 of NFPA 704 provides guidance on both the size of the hazard ratings relative to the size of the placard to be posted and the minimum size of ratings based on the distance at which the ratings are legible.

10. If I have many chemicals in a storage room or if I have mixtures of chemicals, what ratings should I use on the NFPA 704 placard?

Section 4.2.3.3 of NFPA 704 provides three different methods to rate multiple chemicals. In addition, professional judgment must still be used to increase or decrease the rating to more accurately assess the degree of hazard, perhaps due to quantities, or synergistic effects of the chemicals, etc. The ratings for a chemical that contains multiple ingredients should be obtained from data for the mixture as presented on the SDS.

11. How do OSHA's Hazard Communication Classification Numbers differ from NFPA 704 Ratings?

The NFPA 704 standard and OSHA's Hazard Communication standard were developed for different purposes. Now that OSHA has adopted GHS both systems involve numbers leading to many questions about how the two numbers systems relate.

The NFPA 704 standard is widely used and recognized by fire and emergency responders and safety personnel for identifying the hazards of short term/acute exposure to materials under conditions of fire, spill, or similar emergencies. OSHA's Hazard Communication Standard (HCS)

provides information for workers exposed to materials primarily under normal conditions of use.

With OSHA's recent incorporation of the Globally Harmonized System (GHs) into its HCS, it is important to realize that the GHS numbers are not relative ratings of hazards but rather used for the purpose of classifying hazards into categories for proper labeling and training information. These GHS numbers **ARE NOT** relative hazard ratings and in fact have an inverse number systems with 1 being the most hazardous and 4 being the least hazardous. It is important to understand the differences between the two systems.

For more information, NFPA and OSHA have developed a "Quick Card" to explain the two systems and their differences (*found at the end of this section*)

12. Where can I get NFPA 704 related materials?

The 2012 edition of NFPA 704 can be accessed for **free** by going to www.nfpa.org/704. In addition NFPA 704 and the *Fire Protection Guide to Hazardous Materials*, 2010 edition can be purchased by clicking on the Products and Training tab at the www.nfpa.org/704 page or by calling (800) 344-3555.

13. I have additional questions?

NFPA members and code enforcers may submit questions to technical staff by phone at 1-800-344-5555 or submit questions on line by going to www.nfpa.org/704 and clicking on the Technical Questions tab.

Responses to FAQs are prepared by NFPA technical staff to assist users in reading and understanding NFPA codes and standards. The responses, however, are not Formal Interpretations issued pursuant to NFPA Regulations. Any opinions expressed are the personal opinions of the author(s), and do not necessarily represent the official position of the NFPA or its Technical Committees. In addition, the responses are neither intended, nor should be relied upon, to provide professional consultation or services.

APPENDIX B

Ethidium Bromide Treatment and Disposal

Ethidium bromide is a commonly used stain for identifying nucleic acids in electrophoresis gels. It is known to be toxic and mutagenic and may be fatal if swallowed and harmful if inhaled or absorbed through the skin.

Before working with a chemical, know all of the potential hazards and safety precautions by reviewing the material safety data sheet (MSDS). Always wear personal protective equipment including gloves, goggles and a lab coat when working with ethidium bromide. Also, protect yourself from any UV sources that you may use when visually inspecting for ethidium bromide.

Waste Management Procedures

Gels, filters, and other solids containing ethidium bromide *must* be managed as a hazardous chemical waste and disposed of through EH&S. The waste must be double bagged, labeled with an EH&S hazardous waste label and placed in secondary containment. Do not use a biohazardous waste bag to package ethidium bromide waste.

Ethidium bromide solutions *cannot* be disposed of down the sanitary sewer. Ethidium bromide solutions must be treated as part of the experimental protocol or managed as a hazardous chemical waste and disposed of through EH&S.

Charcoal filtration treatment is a simple and effective method for removing ethidium bromide from electrophoresis buffers through a bed of activated charcoal. Prior to drain disposal of the filtered non-hazardous solution, check for fluorescence by using a UV light to ensure complete removal of the ethidium bromide. You can build your own filter or purchase one. When the filter is saturated, the charcoal must be managed as a hazardous chemical waste and disposed of through EH&S.

Charcoal filtration treatment of ethidium bromide solutions must follow the steps outlined in AB966 Benchtop Treatment:

- The laboratory hazardous waste treated is less than 5 gallons or 18 kg per batch whichever is greater.
- The laboratory hazardous waste is treated at the point of generation.
- Treatment is conducted within 10 calendar days of accumulation.
- The person performing the treatment has knowledge of the laboratory hazardous waste being treated, including knowledge of the procedure that generated the waste, and has received hazardous waste training.

Please note that oxidation of ethidium bromide with bleach is not an acceptable destruction technique and must not be used.

Alternatives To Ethidium Bromide

There are less hazardous alternatives to ethidium bromide, SYBR Safe and GelRed/GelGreen for example.

APPENDIX C

Tennessee State University Compatibility Group Classification System

Should be used with specific storage conditions taken from the manufacturer's label and SDS

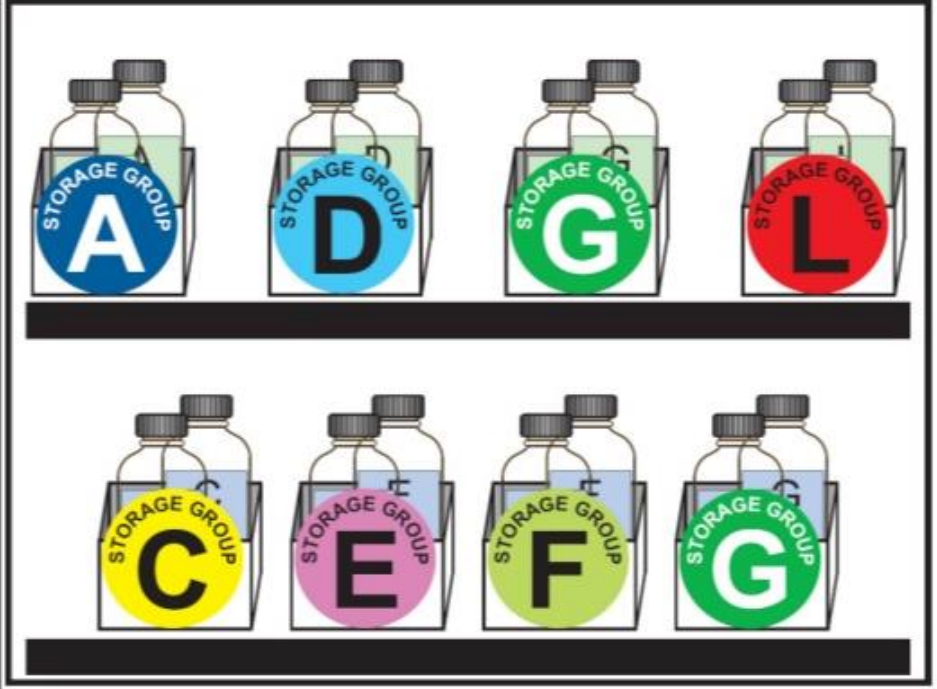
STORAGE GROUPS

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: Contact EH&S**
For specific storage-consult manufacturer's SDS

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.

CHEMICAL SEGREGATION

Chemicals are to be segregated into 11 different categories depending on the compatibility of that chemical with other chemicals

The Storage Groups are as follows:

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

The following is a list of chemicals and their compatibility storage codes. This is not a complete list of chemicals, but is provided to give examples of each storage group:

Storage Group A

94-75-7	2,4-D (2,4-Dichlorophenoxyacetic acid)
94-82-6	2,4-DB
609-99-4	3,5-Dinitrosalicylic acid
64-19-7	Acetic acid (Flammable liquid @ 102°F avoid alcohols, Amines, ox agents see SDS)
631-61-8	Acetic acid, Ammonium salt (Ammonium acetate)
108-24-7	Acetic anhydride (Flammable liquid @102°F avoid alcohols see SDS)
79-10-7	Acrylic acid Peroxide Former
65-85-0	Benzoic acid
98-07-7	Benzotrichloride
98-88-4	Benzoyl chloride
107-92-6	Butyric Acid
115-28-6	Chlorendic acid
79-11-8	Chloroacetic acid
627-11-2	Chloroethyl chloroformate
77-92-9	Citric acid
5949-29-1	Citric acid monohydrate
57-00-1	Creatine
20624-25-3	Diethyldithiocarbamic acid sodium salt
79-44-7	Dimethylcarbamyl chloride
89-65-6	D-Isoascorbic acid (Erythorbic acid)
7200-25-1	DL-Arginine
59-51-8	DL-Methionine
760-78-1	DL-Norvaline, 2-Aminopentanoic acid

302-84-1	DL-Serine
673-06-3	D-Phenylalanine
60-00-4	Ethylenediaminetetraacetic acid (EDTA)
139-33-3	Ethylenediaminetetraacetic acid disodium salt
144-49-0	Fluoroacetic acid
64-18-6	Formic acid
540-69-2	Formic acid ammonium salt, Ammonium formate
590-29-4	Formic acid potassium salt, Potassium formate
142-62-1	Hexanoic acid
97-67-6	L-(-)-Malic acid
79-33-4	L-(+)-Lactic acid
50-21-5	Lactic acid
50-81-7	L-Ascorbic acid, Vitamin C
56-84-8	L-Aspartic acid
143-07-7	Lauric acid
56-86-0	L-Glutamic acid
71-00-1	L-Histidine
463-40-1	Linolenic acid
73-32-5	L-Isoleucine
61-90-5	L-Leucine, (S)-2-Amino-4-methylpentanoic acid
657-26-1	L-Lysine dihydrochloride
39665-12-8	L-Lysine monohydrate
657-27-2	L-Lysine monohydrochloride
63-91-2	L-Phenylalanine
147-85-3	L-Proline
72-18-4	L-Valine
108-31-6	Maleic anhydride
6915-15-7	Malic acid
544-63-8	Myristic acid
59-67-6	Nicotinic acid
139-13-9	Nitrilotriacetic acid
124-07-2	Octanoic acid
112-80-1	Oleic acid
144-62-7	Oxalic acid
6153-56-6	Oxalic acid dihydrate
57-10-3	Palmitic acid
10450-60-9	Periodic acid (solution)
83-86-3	Phytic acid
88-89-1	Picric acid, moist (10-40% water)
877-24-7	Potassium hydrogen phthalate, KHP
79-09-4	Propionic acid
69-72-7	Salicylic acid
7783-00-8	Selenious acid
532-32-1	Sodium Benzoate
141-53-7	Sodium formate
54-21-7	Sodium salicylate
140-10-3	trans-Cinnamic acid
76-03-9	Trichloroacetic acid
76-05-1	Trifluoroacetic acid (TFA)

Storage Group B

21205-91-4	9-BBN

7783-70-2	Antimony pentafluoride
7440-39-3	Barium
98-88-4	Benzoyl chloride
353-42-4	Boron triflouride compound with methyl ether (1:1)
7440-70-2	Calcium
75-20-7	Calcium carbide
156-62-7	Calcium cyanamide
16853-85-3	Lithium aluminum hydride
4111-54-0	Lithium diisopropylamide
7580-67-8	Lithium hydride
7439-93-2	Lithium metal (e.g., in THF)
7439-95-4	Magnesium
7439-96-5	Manganese (powder)
124-63-0	Methanesulfonyl chloride
676-97-1	Methyl phosphonic dichloride
917-54-4	Methyllithium solution (and other alkyls)
17242-52-3	Potassium amide Peroxide Former
7440-09-7	Potassium metal Peroxide Former
7782-92-5	Sodium amide
16940-66-2	Sodium borohydride
7646-69-7	Sodium hydride
594-19-4	Tert-Butyllithium
7440-66-6	Zinc (fume or dust)

Storage Group C

1336-21-6	Ammonium hydroxide
17194-00-2	Barium hydroxide
1305-62-0	Calcium hydroxide
21351-79-1	Cesium hydroxide
1310-65-2	Lithium hydroxide
1310-58-3	Potassium hydroxide
1310-82-3	Rubidium hydroxide
8006-28-8	Soda lime
1310-73-2	Sodium hydroxide
7601-54-9	Sodium phosphate
7558-79-4	Sodium phosphate dibasic
7782-85-6	Sodium phosphate dibasic heptahydrate
10101-89-0	Sodium phosphate tribasic dodecahydrate
13573-18-7	Sodium tripolyphosphate
7758-29-4	Sodium tripolyphosphate
18480-07-4	Strontium hydroxide

Storage Group D

95-54-5	1,2-Phenylenediamine
108-45-2	1,3-Phenylenediamine
624-18-0	1,4-Phenylenediamine dihydrochloride
101-75-7	4-(Phenylazo)diphenylamine
2465-27-2	Auramine O
100-85-6	Benzyltrimethylammonium hydroxide
149358-73-6	Chloramine T hydrate
7080-50-4	Chloramine T trihydrate
25376-45-8	Diaminotoluene (mixed isomers)
111-42-2	Diethanolamine

99-98-9	Dimethyl-p-phenylenediamine
122-39-4	Diphenylamine
541-69-5	m-Phenylenediamine dihydrochloride
93-05-0	N, N -Diethyl-P-Phenylenediamine
552-46-5	Naphtyhylamine hydrochloride
621-64-7	N-Nitrosodi-N-propylamine
86-30-6	N-Nitrosodiphenylamine
77-86-1	Tris base, Tris(hydroxymethyl) aminomethane

Storage Group E

937-14-4	3-Chloroperoxybenzoic acid (organic peroxide see SDS)
13473-90-0	Aluminum nitrate
7784-27-2	Aluminum nitrate nonahydrate
7789-09-5	Ammonium dichromate
6484-52-2	Ammonium nitrate
7790-98-9	Ammonium perchlorate
13446-10-1	Ammonium permanganate
7727-54-0	Ammonium persulfate
10022-31-8	Barium nitrate
10035-06-0	Bismuth (III) nitrate pentahydrate
10361-46-3	Bismuth nitrate oxide
10124-37-5	Calcium nitrate
1305-79-9	Calcium peroxide
16774-21-3	Ceric ammonium nitrate (Ammonium cerium (IV) nitrate)
7789-02-8	Chromium (III) nitrate nonahydrate (chromium nitrate)
1333-82-0	Chromium (VI) oxide
19004-19-4	Copper (II) (Cupric) nitrate hemi(pentahydrate)
3251-23-8	Copper (II) nitrate
13778-31-9	Copper (II) nitrate hydrate
506-93-4	Guanidine nitrate
7722-84-1	Hydrogen peroxide
12029-98-0	Iodopentoxide, Iodine Pentoxide, diiodine Pentoxide
7782-61-8	Iron (III) nitrate nonahydrate (ferric nitrate)
10099-74-8	Lead nitrate
13840-33-0	Lithium hypochlorite
7790-69-4	Lithium nitrate
10377-60-3	Magnesium nitrate
10034-81-8	Magnesium perchlorate
13478-00-7	Nickel (II) nitrate hexahydrate
13138-45-9	Nickel nitrate
10450-60-9	Periodic acid (crystalline powder)
51429-74-4	Phosphomolybdic acid hydrate
7758-01-2	Potassium bromate (solid)
3811-04-9	Potassium chlorate
7778-50-9	Potassium dichromate
7758-05-6	Potassium iodate
7757-79-1	Potassium nitrate
7758-09-0	Potassium nitrite
7722-64-7	Potassium permanganate
7727-21-1	Potassium persulfate
17014-71-0	Potassium superoxide

7761-88-8	Silver nitrate
15630-89-4	Sodium carbonate peroxide
7775-09-9	Sodium chlorate
7758-19-2	Sodium chlorite
2893-78-9	Sodium dichloro-s-triazinetrione
10588-01-9	Sodium dichromate
7789-12-0	Sodium dichromate dihydrate
13600-98-1	Sodium hexanitrocobaltate (III)
7681-52-9	Sodium hypochlorite
7631-99-4	Sodium nitrate
7632-00-0	Sodium nitrite
10101-50-5	Sodium permanganate
1313-60-6	Sodium peroxide
7775-27-1	Sodium persulfate
7791-10-8	Strontium chlorate
10042-76-9	Strontium nitrate
1314-18-7	Strontium peroxide
87-90-1	Trichloro-s-triazinetrione (Trichloroisocyanuric acid, TCCA)
10196-18-6	Zinc nitrate hexahydrate
13778-30-8	Zinc nitrate hydrate

Storage Group F

10043-35-3	Boric acid
7790-93-4	Chloric acid
10034-85-2	Hydrioic acid
7647-01-0	Hydrochloric acid
37267-86-0	meta-Phosphoric acid
12054-85-2	Molybdic acid ammonium
7697-37-2	Nitric acid
7601-90-3	Perchloric acid
7664-38-2	Phosphoric acid
13598-36-2	Phosphorous acid
7699-41-4	Silicic acid (avoid HF)
7664-93-9	Sulfuric acid

Storage Group G

83-88-5	(-)-Riboflavin
85-85-8	1-(2-Pyridylazo)-2-naphthol
4080-31-3	1-(3-Chloroallyl)-3,5,7-triaza-1-azoniaadamantane chloride
5344-82-1	1-(o-Chlorophenyl)thiourea
66-71-7	1, 10-Phenanthroline
5144-89-8	1, 10-Phenanthroline monohydrate
630-20-6	1,1,1,2-Tetrachloroethane
71-55-6	1,1,1-Trichloroethane (methyl chloroform)
79-34-5	1,1,2,2-Tetrachloroethane
79-00-5	1,1,2-Trichloroethane
5124-30-1	1,1-Methylene bis(4-isocyanatocyclohexane)
120-82-1	1,2,4-Trichlorobenzene
106-93-4	1,2-Dibromoethane (ethylene dibromide)
132-86-5	1,3-Dihydroxynaphthalene, Naphthoresorcinol
104-49-4	1,4-Phenylene diisocyanate
3173-72-6	1,5-Naphthalene diisocyanate
230-46-6	1,7-Phenanthroline

180001-34-7	1400W dihydrochloride
82-28-0	1-Amino-2-methylanthraquinone
90-15-3	1-Naphthol
620-45-1	2, 6-Dichlorophenolindophenol sodium salt hydrate
76-54-0	2, 7 -Dichlorofluorescein (solid)
771-97-1	2,3 -Diaminonaphthalene
88-06-2	2,4,6-Trichlorophenol (solid)
2971-38-2	2,4-D Chlorocrotyl ester
94-11-1	2,4-D Isopropyl ester
615-05-4	2,4-Diaminoanisole
95-80-7	2,4-Diaminotoluene
120-83-2	2,4-Dichlorophenol (crystalline)
105-67-9	2,4-Dimethylphenol
53-96-3	2-Acetylaminofluorene
75-88-7	2-Chloro-1,1,1-trifluoro-ethane (HCFC-133a)
888724-51-4	2-Hydroxyethy-trimethylammonium L-(+)-lactate
149-30-4	2-Mercaptobenzothiazole (MBT)
60-24-2	2-Mercaptoethanol
88-75-5	2-Nitrophenol
90-43-7	2-Phenylphenol
20325-40-0	3, 3-Dimethoxybenzidine dihydrochloride
91-94-1	3,3'-Dichlorobenzidine (solid)
91-97-4	3,3'-Dimethyl-4,4'-diphenylene diisocyanate
56-49-5	3-Methylcholanthrene (solid)
101-80-4	4,4'-Diaminodiphenyl ether
101-77-9	4,4'-Diaminodiphenylmethane
80-05-7	4,4'-Isopropylidenediphenol
101-14-4	4,4'-Methylenebis(2-chloroaniline) (mboca)
101-61-1	4,4'-Methylenebis(N,N-dimethyl) benzenamine
534-52-1	4,6-Dinitro-o-cresol
60-09-3	4-Aminoazobenzene
92-67-1	4-Aminodiphenyl
504-24-5	4-Aminopyridine
100-10-7	4-Dimethylamino benzaldehyde
60-11-7	4-Dimethylaminoazobenzene
92-93-3	4-Nitrobiphenyl
100-02-7	4-Nitrophenol
92-69-3	4-Phenylphenol, 4-Hydroxybiphenyl
99-55-8	5-Nitro-o-toluidine
57-97-6	7,12-Dimethylbenz[a]anthracene
71751-41-2	Abamectin [avermectin b1]
640-19-7	Acetamide, 2-fluoro-
62-74-8	Acetic acid, fluoro-, sodium salt
1752-30-3	Acetone thiosemicarbazide
79-06-1	Acrylamide
309-00-2	Aldrin
72-48-0	Alizarin red
584-42-9	Alizarin yellow
569-58-4	Aluminon
7446-70-0	Aluminum chloride
7429-90-5	Aluminum non powder

10043-01-3	Aluminum sulfate
17927-65-0	Aluminum sulfate hydrate
7784-31-8	Aluminum sulfate octadecahydrate
54-62-6	Aminopterin
61-82-5	Amitrole
631-61-8	Ammonium acetate
12124-97-9	Ammonium bromide
12125-02-9	Ammonium chloride
12027-06-4	Ammonium iodide
1185-57-5	Ammonium iron (III) citrate, Ferric ammonium citrate
7783-83-7	Ammonium iron (III) sulfate, Ferric ammonium sulfate
13106-76-8	Ammonium molybdate
7783-13-3	Ammonium sodium phosphate dibasic tetrahydrate
7783-20-2	Ammonium sulfate
1762-95-4	Ammonium thiocyanate
101-05-3	Anilazine [4, 6-dichloro-N-(2-chlorophenyl)-1, 3, 5-triazin-2-amine]
7440-36-0	Antimony
7440-38-2	Arsenic
1303-28-2	Arsenic pentoxide
7784-34-1	Arsenic trichloride
1327-53-3	Arsenic trioxide
86-50-0	Azinphos-methyl
10361-37-2	Barium chloride
10326-27-9	Barium chloride dihydrate
63126-89-6	Benedict's reagent
56-55-3	Benz[a]anthracene (solid)
55-21-0	Benzamide
100-14-1	Benzene, 1-(chloromethyl)-4-nitro-
98-05-5	Benzenearsonic acid
92-87-5	Benzidine
50-32-8	Benzo[a]pyrene
57-64-7	Benzoic acid, 2-hydroxy-, compound with (3as-cis)-1,2,3,3a,8,8a-hexahydro-1,3a,8-trimethylpyrrolo[2,3,b]indol-5-ylmethylcarbamate ester (1:1)
992-59-6	Benzopurpurin 4B
140-29-4	Benzyl cyanide
7440-41-7	Beryllium powder
91-59-8	Beta-naphthylamine
82657-04-3	Bifenthrin (solid)
92-52-4	Biphenyl (crystalline)
7440-69-9	Bismuth
6104-58-1	Brilliant blue G
633-03-4	Brilliant green, Malachite green
28772-56-7	Bromadiolone
76-60-8	Bromocresol green
115-40-2	Bromocresol purple
75-25-2	Bromoform (tribromomethane)
115-39-9	Bromophenol blue
76-59-5	Bromothymol blue
34722-90-2	Bromothymol blue sodium salt
75-63-8	Bromotrifluoromethane (halon 1301)

83-46-5	b-Sitosterol
81-88-9	C.I. Food red 15 (Rhodamine B)
97-56-3	C.I. Solvent yellow 3
7440-43-9	Cadmium
10325-94-7	Cadmium ion standard (cadmium nitrate)
1306-19-0	Cadmium oxide
2223-93-0	Cadmium stearate
7778-44-1	Calcium arsenate
71626-99-8	Calcium bromide hydrate
471-34-1	Calcium carbonate
10043-52-4	Calcium chloride anhydrous
1305-78-8	Calcium oxide
7778-18-9	Calcium sulfate
56-25-7	Cantharidin
51-83-2	Carbachol chloride
644-64-4	Carbamic acid, dimethyl-, 1-[(dimethylamino)carbonyl]-5-methyl-1h-pyrazol-3-yl ester
63-25-2	Carbaryl [1-naphthalenol, methylcarbamate] (solid)
1563-66-2	Carbofuran
7440-44-0	Carbon (activated Charcoal)
56-23-5	Carbon tetrachloride
7647-17-8	Cesium chloride
56-75-7	Chloramphenicol
57-74-9	Chlordane
75-45-6	Chlorodifluoromethane (HCFC-22)
67-66-3	Chloroform
865-49-6	Chloroform-d
63938-10-3	Chlorotetrafluoroethane
75-72-9	Chlorotrifluoromethane (CFC-13)
1982-47-4	Chloroxuron
60-31-1	Choline (Acetylcholine chloride)
7440-47-3	Chromium
10025-73-7	Chromium (III) chloride (Chromic chloride)
1308-38-9	Chromium (III) oxide (Chromic oxide)
3564-18-9	Chromoxane cyanine (Eriochrome)
7440-48-4	Cobalt
71-48-7	Cobalt (II) acetate
7646-79-9	Cobalt (II) chloride
7791-13-1	Cobalt (II) chloride hexahydrate
10141-05-6	Cobalt (II) nitrate
10124-43-3	Cobalt (II) sulfate
10026-24-1	Cobalt (II) sulfate heptahydrate
64-86-8	Colchicine
573-58-0	Congo Red
7440-50-8	Copper
7758-89-6	Copper (I) chloride (cuprous)
1317-39-1	Copper (I) oxide (cuprous)
7758-99-8	Copper (II) (Cupric) sulfate pentahydrate
142-71-2	Copper (II) acetate (cupric)
12069-69-1	Copper (II) carbonate
7447-39-4	Copper (II) chloride

10125-13-0	Copper (II) chloride dihydrate
1317-38-0	Copper (II) oxide
7758-98-7	Copper (II) sulfate (cupric)
8001-30-7	Corn oil
56-72-4	Coumaphos
5836-29-3	Coumatetralyl
1733-12-6	Cresol red
535-89-7	Crimidine
548-62-9	Crystal violet
21725-46-2	Cyanazine
506-68-3	Cyanogen bromide (crystalline)
506-78-5	Cyanogen iodide
675-14-9	Cyanuric fluoride
66-81-9	Cycloheximide
65-46-3	Cytidine
71-30-7	Cytosine
10323-20-3	D-(-)-Arabinose
138-52-3	D-(-)-Salicin
66-84-2	D-(+)-Glucosamine hydrochloride
3458-28-4	D-(+)-Mannose
17629-30-0	D-(+)-Raffinose pentahydrate
9011-18-1	Dextran sulfate sodium salt
61790-53-2	Diatomaceous earth, celite
68855-54-9	Diatomite, diatomaceous earth, celite, acid washed
333-41-5	Diazinon
53-70-3	Dibenzo(a, h)anthracene
132-64-9	Dibenzofuran (crystalline)
84-74-2	Dibutyl phthalate
99-30-9	Dichloran [2, 6-dichloro-4-nitroaniline]
75-27-4	Dichlorobromomethane
75-09-2	Dichloromethane (methylene chloride)
127564-92-5	Dichloropentafluoropropane
97-23-4	Dichlorophene [2, 2'-methylene-bis(4-chlorophenol)]
76-14-2	Dichlorotetrafluoroethane (cfc-114)
62-73-7	Dichlorvos
38727-55-8	Diethatyl ethyl
71-63-6	Digitoxin
101-90-6	Diglycidyl resorcinol ether
94-58-6	Dihydrosafrole
55-91-4	Diisopropylfluorophosphate (DFP)
60-51-5	Dimethoate
2524-03-0	Dimethyl chlorothiophosphate
131-11-3	Dimethyl phthalate
2300-66-5	Dimethylamine dicamba
95-45-4	Dimethylglyoxime (flammable solid)
78-34-2	Dioxathion
82-66-6	Diphacinone
957-51-7	Diphenamid
101-84-8	Diphenyl ether (Phenyl ether)
107-49-3	Diphosphoric acid, tetraethyl ester
541-53-7	Dithiobiuret

10318-18-0	DL-Cystenine hydrochloride
72-20-8	Endrin
50-14-6	Ergocalciferol
1787-61-7	Eriochrome
1239-45-8	Ethidium bromide
563-12-2	Ethion
13194-48-4	Ethoprop
759-94-4	Ethyl dipropylthiocarbamate [EPTC]
107-21-1	Ethylene glycol
96-45-7	Ethylene thiourea
6381-92-6	Ethylenediaminetetraacetic acid disodium salt dihydrate
52-85-7	Famphur
55-38-9	Fenthion [o, o-dimethyl o-[3-methyl-4-(methylthio)phenyl]ester, phosphorothioic acid]
1343-88-0	Florisil (Magnesium silicate)
2321-07-5	Fluorescein
359-06-8	Fluoroacetyl chloride
51-21-8	Fluorouracil
107-16-4	Formaldehyde cyanohydrin
75-12-7	Formamide
23422-53-9	Formetanate hydrochloride
76-13-1	Freon 113 [ethane, 1, 1, 2-trichloro-1, 2, 2-trifluoro-]
57-48-7	Fructose
8031-18-3	Fullers Earth
59-23-4	Galactose
9000-70-8	Gelatin
50-99-7	Glucose (Dextrose)
492-62-6	Glucose solution, alpha D Glucose
56-81-5	Glycerol
56-40-6	Glycine
7782-42-5	Graphite
50-01-1	Guanidine hydrochloride
76-44-8	Heptachlor
87-68-3	Hexachloro-1, 3-butadiene
118-74-1	Hexachlorobenzene
77-47-4	Hexachlorocyclopentadiene
67-72-1	Hexachloroethane
1335-87-1	Hexachloronaphthalene
70-30-4	Hexachlorophene
57-09-0	Hexadecyltrimethylammonium bromide
822-06-0	Hexamethylene-1, 6-diisocyanate
51235-04-2	Hexazinone
51-75-2	Hn2 (nitrogen mustard-2)
555-77-1	Hn3 (nitrogen mustard-3)
10034-93-2	Hydrazine sulfate salt
79-19-6	Hydrazinecarbothioamide
123-31-9	Hydroquinone
68-94-0	Hypoxanthine
482-89-3	Indigo
860-22-0	Indigo carmine
120-72-9	Indole

87-89-8	Inositol
7553-56-2	Iodine
305-53-3	Iodoacetic acid sdium salt
7439-89-6	Iron
10045-89-3	Iron (II) ammonium sulfate (Ferrous)
13478-10-9	iron (II) chloride tetrahydrate (Ferrous chloride tetrahydrate)
7782-63-0	Iron (II) sufate heptahydrate (ferrous)
13463-43-9	Iron (II) sulfate hydrate (Ferrous sulfate)
7705-08-0	iron (III) chloride (Ferric chloride)
10025-77-1	Iron (III) chloride hexahydrate (ferric)
2338-05-8	Iron (III) citrate tribasic monohydrate (ferric)
102-36-3	Isocyanic acid, 3,4-dichlorophenyl ester
465-73-6	Isodrin
4098-71-9	Isophorone diisocyanate
120-58-1	Isosafrole
9000-36-6	Karaya gum
5328-37-0	L-(+)-Arabinose
63-42-3	Lactose
1312-81-8	Lanthanum (III) oxide
30925-07-6	L-Cystine dihydrochloride
7439-92-1	Lead
6080-56-4	Lead (II) acetate trihydrate
592-87-0	Lead (II) thiocyanate
301-04-2	Lead acetate
1335-32-6	Lead subacetate
56-85-9	L-Glutamine
58-89-9	Lindane
3087-16-9	Lissamine green
554-13-2	Lithium carbonate
7447-41-8	Lithium chloride
867-55-0	Lithium lactate
10377-48-7	Lithium sulfate
1393-92-6	Litmus granular
500-44-7	L-Mimosine
9000-40-2	Locust bean gum
10030-85-0	L-Rhamnose monohydrate
6155-35-7	L-Rhamnose monohydrate
16674-78-5	Magnesium acetate tetrahydrate
39409-82-0	Magnesium carbonate
7786-30-3	Magnesium chloride
7791-18-6	Magnesium chloride hexahydrate (crystals)
13446-18-9	Magnesium nitrate hexahydrate
7487-88-9	Magnesium sulfate
10034-99-8	Magnesium sulfate heptahydrate
569-64-2	Malachite green
2437-29-8	Malachite green oxalate salt
121-75-5	Malathion
34156-69-9	Manganese (II) carbonate hydrate
7773-01-5	Manganese (II) chloride
13446-34-9	Manganese (II) chloride tetrahydrate
15244-36-7	Manganese (II) sulfate hydrate (Manganous sulfate)

10034-96-5	Manganese (II) sulfate monohydrate
1313-13-9	Manganese (IV) oxide, Manganese dioxide
7439-96-5	Manganese (not powder)
69-65-8	Mannitol
64-00-6	m-Cumenyl methylcarbamate
93-65-2	Mecoprop
950-10-7	Mephosfolan
1600-27-7	Mercuric acetate
7487-94-7	Mercuric chloride
21908-53-2	Mercuric oxide
7439-97-6	Mercury
7774-29-0	Mercury (II) iodide, Mercuric iodide
7783-34-8	Mercury (II) nitrate monohydrate, Mercuric nitrate monohydrate
7783-35-9	Mercury (II) sulfate, Mercuric sulfate
30674-80-7	Methacryloyloxyethyl isocyanate
558-25-8	Methanesulfonyl fluoride
950-37-8	Methidathion
16752-77-5	Methomyl
94-74-6	Methoxone (4-chloro-2-methylphenoxy) acetic acid (MCPA))
72-43-5	Methoxychlor [benzene, 1, 1'-(2, 2, 2-trichloroethylidene)bis[4-methoxy-]]
151-38-2	Methoxyethylmercuric acetate
134-20-3	Methyl anthranilate
7114-03-6	Methyl green
74-88-4	Methyl iodide
547-58-0	Methyl orange
298-00-0	Methyl parathion
1340-02-9	Methyl purple
493-52-7	Methyl red
119-36-8	Methyl salicylate
2433-97-8	Methyl tricosanoate
8004-87-3	Methyl violet
61-73-4	Methylene blue
502-39-6	Methylmercuric dicyanamide
7786-34-7	Mevinphos
90-94-8	Michler's ketone
8042-47-5	Mineral oil
50-07-7	Mitomycin c
7439-98-7	Molybdenum
1313-27-5	Molybdenum trioxide
76-15-3	Monochloropentafluoroethane (CFC-115)
6923-22-4	Monocrotophos
7440-02-0	Nickel
7718-54-9	Nickel (II) chloride
7791-20-0	Nickel (II) chloride hexahydrate
1313-99-1	Nickel (II) oxide
10101-97-0	Nickel (II) sulfate hexahydrate
54-11-5	Nicotine
65-30-5	Nicotine sulfate
8005-03-6	Nigrosin
3625-57-8	Nile blue A

485-47-2	Ninhydrin
924-42-5	N-Methylolacrylamide
59-89-2	N-Nitrosomorpholine
297-97-2	O,O-Diethyl O-pyrazinyl phosphorothioate
78-53-5	O,O-Diethyl S-[2-(diethylamino)ethyl] phosphorothiolate
90-04-0	o-Anisidine
1320-06-5	Oil Red O
6153-39-5	Orcinol monohydrate
630-60-4	Ouabain
78-71-7	Oxetane, 3,3-bis(chloromethyl)-
104-94-9	p-anisidine
8012-95-1	Paraffin oil
25620-78-4	Pararosaniline
569-61-9	Pararosaniline hydrochloride
56-38-2	Parathion
12002-03-8	Paris green
106-47-8	p-chloroaniline
95-69-2	p-chloro-o-toluidine
100-25-4	p-dinitrobenzene
76-01-7	Pentachloroethane
87-86-5	Pentachlorophenol (PCP)
594-42-3	Perchloromethylmercaptan
85-01-8	Phenanthrene
143-74-8	Phenol red
34487-61-1	Phenol red sodium salt
88-85-7	Phenol, 2-(1-methylpropyl)-4,6-dinitro- (dinoseb)
77-09-8	Phenolphthalein
58-36-6	Phenoxarsine, 10,10'-oxydi-
59-88-1	Phenylhydrazine hydrochloride
62-38-4	Phenylmercury acetate
2097-19-0	Phenylsilatrane
103-85-5	Phenylthiourea
57-41-0	Phenytoin
947-02-4	Phosfolan
13171-21-6	Phosphamidon
8002-43-5	Phosphatidylcholine, Lecithin
57-47-6	Physostigmine
124-87-8	Picrotoxin
51-03-6	Piperonyl butoxide
100-01-6	p-nitroaniline
9005-64-5	Polyoxyethylene 20 sorbitan monolaurate
127-08-2	Potassium acetate
10124-50-2	Potassium arsenite
298-14-6	Potassium bicarbonate
7758-02-3	Potassium bromide
584-08-7	Potassium carbonate
7447-40-7	Potassium chloride
7789-00-6	Potassium chromate
590-28-3	Potassium cyanate
13746-66-2	Potassium ferricyanide, potassium hexacyanoferate
13943-58-3	Potassium ferrocyanide, potassium hexacyanoferrate(II) trihydrate

7789-23-3	Potassium fluoride
7681-11-0	Potassium iodide
868-14-4	Potassium L-tartrate monobasic
6487-48-5	Potassium oxalate
7758-11-4	Potassium phosphate dibasic
7778-77-0	Potassium phosphate monobasic
506-61-6	Potassium silver cyanide
6381-59-5	Potassium sodium tartrate tetrahydrate
7778-80-5	Potassium sulfate
10117-38-1	Potassium sulfite
6100-19-2	Potassium tartrate dibasic hemihydrate
333-20-0	Potassium thiocyanate
106-50-3	p-phenylenediamine
23950-58-5	Pronamide
1120-71-4	Propane sultone
70-69-9	Propiophenone, 4'-amino
121-79-9	Propyl gallate
1332-09-8	Pumice stone
129-00-0	Pyrene
115-41-3	Pyrocatechol violet
87-66-1	Pyrogallol
92-32-0	Pyronin Y
91-22-5	Quinoline
82-68-8	Quintozene [pentachloronitrobenzene]
1555-56-2	rac-Glycerol 1-phosphate disodium salt
62758-13-8	Resazurin sodium salt
50-55-5	Reserpine
108-46-3	Resorcinol, 1,3-Benzenediol
78-48-8	S,S,S-tributyltrithiophosphate (DEF)
81-07-2	Saccharin (manufacturing, no supplier notification)
128-44-9	Saccharin sodium
82385-42-0	Saccharin sodium
94-59-7	Safrole
9050-94-6	Sephadex G-10
112945-52-5	Silica
7631-86-9	Silica
112926-00-8	Silica gel, Silicon dioxide
409-21-2	Silicon carbide
14808-60-7	Silicon dioxide (sand)
63148-62-9	Silicone oil
7440-22-4	Silver
563-63-3	Silver acetate
10294-26-5	Silver sulfate
127-09-3	Sodium acetate
7631-89-2	Sodium arsenate
7784-46-5	Sodium arsenite, solid
144-55-8	Sodium bicarbonate
7681-38-1	Sodium bisulfate
10034-88-5	Sodium bisulfate monohydrate
7631-90-5	Sodium bisulfite
7647-15-6	Sodium bromide

124-65-2	Sodium cacodylate
497-19-8	Sodium carbonate
9004-32-4	Sodium carboxymethyl cellulose
7647-14-5	Sodium chloride
7775-11-3	Sodium chromate
6132-04-3	Sodium citrate
1236-96-5	Sodium diacetate
128-04-1	Sodium dimethyldithiocarbamate
7681-49-4	Sodium floride
7681-82-5	Sodium iodide
7681-57-4	Sodium metabisulfite
62-76-0	Sodium oxalate
7558-80-7	Sodium phosphate monobasic
10049-21-5	Sodium phosphate monobasic monohydrate
13410-01-0	Sodium selenate
10102-18-8	Sodium selenite
7757-82-6	Sodium sulfate
1313-84-4	Sodium sulfide nonahydrate
7757-83-7	Sodium sulfite
10102-20-2	Sodium tellurite
1303-96-4	Sodium tetraborate decahydrate
1330-43-4	Sodium tetraborate, sodium borate
540-72-7	Sodium thiocyanate
7772-98-7	Sodium thiosulfate
10102-17-7	Sodium thiosulfate pentahydrate
50-70-4	Sorbitol
9005-25-8	Starch
9005-84-9	Starch
57-24-9	Strychnine
57-50-1	Sucrose
7704-34-9	Sulfur
79-94-7	Tetrabromobisphenol A
64-75-5	Tetracycline hydrochloride
3689-24-5	Tetraethyldithiopyrophosphate
9002-84-0	Tetrafluoroethylene Peroxide Former
7440-28-0	Thallium
6533-73-9	Thallous carbonate
62-55-5	Thioacetamide
59669-26-0	Thiodicarb
62-56-6	Thiourea
614-78-8	Thiourea, (2-methylphenyl)-
137-26-8	Thiram
1314-20-1	Thorium dioxide
76-61-9	Thymol Blue
125-20-2	Thymolphthalein
7440-31-5	TIn
7772-99-8	Tin (II) chloride
7646-78-8	Tin (IV) chloride, stannic chloride
12070-08-5	Titanium (IV) carbide
119-93-7	Tolidine
8001-35-2	Toxaphene

68-76-8	Triaziquone [2, 5-cyclohexadiene-1, 4-dione, 2, 3, 5-tris(1-aziridinyl)-]
24017-47-8	Triazophos
1983-10-4	Tributyltin fluoride
52-68-6	Trichlorfon [phosphonic acid, (2, 2, 2-trichloro-1-hydroxyethyl)-, dimethyl ester]
75-69-4	Trichlorofluoromethane (CFC-11)
327-98-0	Trichloronate
76-87-9	Triphenyltin hydroxide
57455-37-5	Ultramarine blue ebex
57-13-6	Urea
7440-62-2	Vanadium (except when contained in an alloy)
1314-62-1	Vanadium pentoxide
81-81-2	Warfarin
129-06-6	Warfarin sodium
7732-18-5	Water
28347-13-9	Xylylene dichloride
7646-85-7	Zinc chloride
1314-13-2	Zinc oxide

Storage Group J

7664-41-7	Ammonia
74-83-9	Bromomethane
116-15-4	Hexafluoropropylene
7446-09-5	Sulfur dioxide

Storage Group K

556-88-7	Nitroguanidine
288-94-8	Tetrazole
124-47-0	Urea nitrate

Storage Group L

123-73-9	(e)-Crotonaldehyde
5989-54-8	(S)-(-)-Limonene
96-12-8	1,2-Dibromo-3-chloropropane
95-50-1	1,2-Dichlorobenzene
541-73-1	1,3-Dichlorobenzene
764-41-0	1,4-Dichloro-2-butene
106-46-7	1,4-Dichlorobenzene
111-29-5	1,5-Pentanediol
71-41-0	1-Pentanol
109-67-1	1-Pentene
71-23-8	1-Propanol
88-06-2	2,4,6-Trichlorophenol (solution)
88-05-1	2,4,6-Trimethyl-aniline
120-83-2	2,4-Dichlorophenol (solution)
51-28-5	2,4-Dinitrophenol Solution
119-26-6	2,4-Dinitrophenylhydrazine
87-62-7	2,6-Xylidine
76-54-0	2,7-Dichlorofluorescein (solution)
78-92-2	2-Butanol (sec butanol)
78-93-3	2-Butanone (MEK)
532-27-4	2-Chloroacetophenone (solid)

110-80-5	2-Ethoxyethanol
88-09-5	2-Ethylbutyric acid
109-86-4	2-Methoxyethanol
109-06-8	2-Methylpyridine
79-46-9	2-Nitropropane
67-63-0	2-Propanol Peroxide Former
2530-85-0	3-(Trimethoxysilyl) propyl methacrylate
91-94-1	3,3'-Dichlorobenzidine (solution)
91-93-0	3,3'-Dimethoxybenzidine-4,4'-diisocyanate
542-76-7	3-Chloropropionitrile
56-49-5	3-Methylcholanthrene (solution)
105-57-7	Acetal Peroxide Former
67-64-1	Acetone
75-05-8	Acetonitrile
98-86-2	Acetophenone
107-13-1	Acrylonitrile, inhibited
111-69-3	Adiponitrile
557-40-4	Allyl ether
98-16-8	Benzenamine, 3-(trifluoromethyl)-
71-43-2	Benzene
108-98-5	Benzenethiol
100-44-7	Benzyl chloride
103-50-4	Benzyl ether
100-46-9	Benzylamine
110-47-4	Beta-isopropoxypropionitrile
82657-04-3	Bifenthrin (solution)
92-52-4	Biphenyl (solution)
534-07-6	Bis(chloromethyl) ketone (solid)
542-88-1	Bis(chloromethyl)ether
106-99-0	Butadiene Peroxide Former
141-32-2	Butyl acrylate
63-25-2	Carbaryl [1-naphthalenol, methylcarbamate] (solution)
75-15-0	Carbon disulfide (Flammable avoid amines see MSDS)
107-30-2	Chloromethyl methyl ether
8001-58-9	Creosote
1319-77-3	Cresol (mixed isomers)
4170-30-3	Crotonaldehyde
98-82-8	Cumene Peroxide Former
110-82-7	Cyclohexane
108-93-0	Cyclohexanol
110-83-8	Cyclohexene Peroxide Former
108-91-8	Cyclohexylamine
931-87-3	Cyclooctene Peroxide Former
142-29-0	Cyclopentene Peroxide Former
91-17-8	Decahydronaphthalene
919-86-8	Demeton-s-methyl
132-64-9	Dibenzofuran (solution)
75-71-8	Dichlorodifluoromethane (cfc-12)
111-44-4	Dichloroethyl ether
75-43-4	Dichlorofluoromethane (HCFC-21)
696-28-6	Dichlorophenylarsine

77-73-6	Dicyclopentadiene Peroxide Former
1464-53-5	Diepoxybutane
462-95-3	Diethoxymethane
814-49-3	Diethyl chlorophosphate
111-96-6	Diethylene glycol dimethyl ether Peroxide Former
109-87-5	Dimethoxymethane
77-78-1	Dimethyl sulfate
67-68-5	Dimethyl sulfoxide DMSO
2206-27-14-17-5	Dimethyl sulfoxide-d6
124-40-3	Dimethylamine
123-91-1	Dioxane Peroxide Former
821-08-9	Divinyl acetylene Peroxide Former
64-17-5	Ethanol (ethyl alcohol)
141-78-6	Ethyl acetate
140-88-5	Ethyl acrylate Peroxide Former
105-54-4	Ethyl butyrate
75-00-3	Ethyl chloride
107-12-0	Ethyl cyanide
60-29-7	Ethyl ether Peroxide Former
75-04-7	Ethylamine
100-41-4	Ethylbenzene
74-85-1	Ethylene
371-62-0	Ethylene fluorohydrin
110-71-4	Ethylene glycol dimethyl ether Peroxide Former
75-34-3	Ethylidene dichloride
542-90-5	Ethylthiocyanate
115-21-9	Ethyltrichlorosilane
944-22-9	Fonofos
50-00-0	Formaldeyde
110-00-9	Furan Peroxide Former
90-05-1	Guaiacol (crystalline)
142-82-5	Heptane
110-54-3	Hexane
123-51-3	Isoamyl alcohol, 3-Methyl-1-butanol
78-82-0	Isobutyronitrile
540-84-1	Isooctane (2,2,4-Trimethylpentane)
98-82-8	Isopropyl benzene
108-23-6	Isopropyl chloroformate
108-20-3	Isopropyl ether Peroxide Former
78-97-7	Lactonitrile
25999-20-6	Lasalocid A sodium salt solution
97660-01-0	Lavender oil, 45%
109-77-3	Malononitrile (solid)
760-93-0	Methacrylic anhydride
126-98-7	Methacrylonitrile
67-56-1	Methanol (Methyl alcohol)
80-63-7	Methyl 2-chloroacrylate
74-99-7	Methyl acetylene Peroxide Former
96-33-3	Methyl acrylate
74-87-3	Methyl chloride

96-37-7	Methyl cyclopentane Peroxide Former
108-10-1	Methyl isobutyl ketone (MIBK) Peroxide Former
67-68-5	Methyl sulfoxide
1634-04-4	Methyl tert-butyl ether
68-12-2	N,N-Dimethylformamide
91-20-3	Naphthalene
71-36-3	n-Butanol
1122-60-7	Nitrocyclohexane
75-52-5	Nitromethane (avoid amines see MSDS)
872-50-4	N-Methyl-2-pyrrolidone
62-75-9	N-Nitrosodimethylamine
100-75-4	N-Nitrosopiperidine
95-48-7	o-Cresol (powder)
95-53-4	o-Toluidine
95-47-6	o-Xylene
106-51-4	p-Benzoquinone (Quinone) (powder)
106-44-5	p-cresol (crystalline /liquid)
109-66-0	Pentane
8032-32-4	Petroleum ether
108-95-2	Phenol
110-89-4	Piperidine
123-38-6	Propionaldehyde
106-42-3	p-Xylene
110-86-1	Pyridine
151-21-3	Sodium dodecyl sulfate (solid)
100-42-5	Styrene Peroxide Former
75-65-0	tert-Butanol
597-64-8	Tetraethyltin
109-99-9	Tetrahydrofuran Peroxide Former
119-64-2	Tetrahydronaphthalene Peroxide Former
75-74-1	Tetramethyllead
108-88-3	Toluene (Methyl benzene)
102-71-6	Triethanolamine
121-44-8	Triethylamine
51-79-6	Urethane (ethyl carbamate) (crystalline)
108-05-4	Vinyl acetate
108-05-4	Vinyl acetate Peroxide Former
75-01-4	Vinyl chloride Peroxide Former
109-93-3	Vinyl ether Peroxide Former
	Vinyl pyridine Peroxide Former
1330-20-7	Xylene (mixed isomers)

Storage Group X

57-14-7	1,1-Dimethylhydrazine
96-18-4	1,2,3-Trichloropropane
78-88-6	2,3-Dichloropropene
121-14-2	2,4-Dinitrotoluene
606-20-2	2,6-Dinitrotoluene
75-86-5	2-Methyllactonitrile
107-02-8	Acrolein
814-68-6	Acrylyl chloride

107-18-6	Allyl alcohol
107-05-1	Allyl chloride
107-11-9	Allylamine
7429-90-5	Aluminum powder
62-53-3	Aniline
622-79-7	Benzyl azide
7726-95-6	Bromine
109-72-8	Butyllithium
107-07-3	Chloroethanol
76-06-2	Chloropicrin
10210-68-1	Cobalt carbonyl
334-88-3	Diazomethane
64-67-5	Diethyl sulfate
109-89-7	Diethylamine
75-78-5	Dimethyldichlorosilane
25321-14-6	Dinitrotoluene (mixed isomers)
106-89-8	Epichlorohydrin
541-41-3	Ethyl chloroformate
107-15-3	Ethylenediamine
151-56-4	Ethyleneimine
302-01-2	Hydrazine
74-90-8	Hydrogen cyanide
7664-39-3	Hydrogen fluoride
13463-40-6	Iron, pentacarbonyl-
556-61-6	Isothiocyanatomethane
99-65-0	m-Dinitrobenzene
920-46-7	Methacryloyl chloride
79-22-1	Methyl chloroformate
60-34-4	Methyl hydrazine
624-83-9	Methyl isocyanate
74-93-1	Methyl mercaptan
80-62-6	Methyl Methacrylate Peroxide Former Flammable avoid amines inorganics
80-62-6	Methyl methracrylate
556-64-9	Methyl thiocyanate
78-94-4	Methyl vinyl ketone
74-95-3	Methylene bromide
101-68-8	Methylenebis(phenylisocyanate) (MDI)
98-95-3	Nitrobenzene
55-63-0	Nitroglycerine
104-12-1	p-Chlorophenyl isocyanate
79-21-0	Peracetic acid
98-13-5	Phenyltrichlorosilane
7723-14-0	Phosphorus
10025-87-3	Phosphorus oxychloride
10026-13-8	Phosphorus pentachloride
7719-12-2	Phosphorus trichloride
85-44-9	Phthalic anhydride
151-50-8	Potassium cyanide
107-19-7	Propargyl alcohol
109-61-5	Propyl chloroformate
7723-14-0	Red phosphorus
26628-22-8	Sodium azide
143-33-9	Sodium cyanide
64568-18-9	Sodium hydrogen sulfide

60-41-3	Strychnine, sulfate
505-60-2	Sulfur mustard (mustard gas H)
7446-11-9	Sulfur trioxide
77-81-6	Tabun
78-00-2	Tetraethyl lead
584-84-9	Toluene-2,4-diisocyanate
91-08-7	Toluene-2,6-diisocyanate
26471-62-5	Toluenediisocyanate (mixed isomers)
1558-25-4	Trichloro(chloromethyl)silane
79-01-6	Trichloroethylene
824-11-3	Trimethylolpropane phosphite
57-57-8	β-Propiolactone

APPENDIX D

Compressed Gas & Cryogenic Liquid Cylinder Safety

Introduction

Some CMNBTR laboratory operations require the use of compressed gases for a variety of different operations. Depending on the particular gas or cryogenic liquid, there is a potential for mechanical and chemical hazards. Everyone should be aware of the hazards associated with compressed gases & cryogenic liquids and their cylinders before using or transporting them. All individuals who work with compressed gasses and cryogenic liquids must read the SDS of the agent before handling. They must use proper Personal Protective Equipment (PPE), if needed, when working with or handling the cylinders.

Dangers of Compressed Gas & Cryogenic Liquid Cylinder

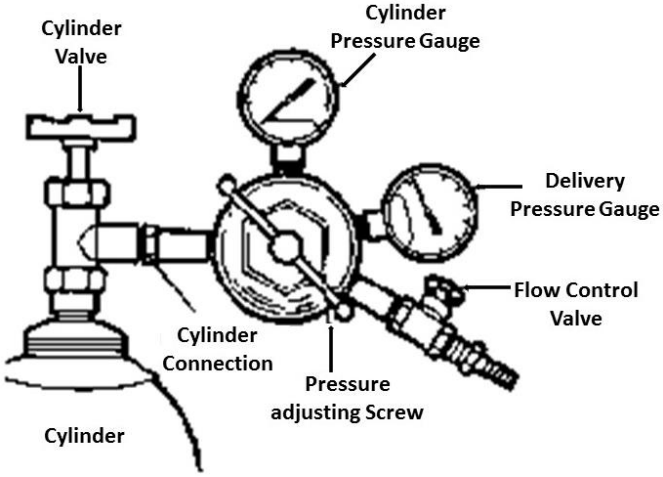
Compressed gases and cryogenic liquids are contained in heavy, highly pressurized metal containers; the large amount of potential energy resulting from compression of the gas makes the cylinder a potential rocket or fragmentation bomb. Inert gases can produce conditions of oxygen depletion that could lead to asphyxiation.

Many cylinders contain pressures that are in excess of 2000 pounds per square inch. A broken valve can cause a cylinder to become an unguided missile. Never deliberately breathe, or allow others to breathe any compressed gas of any type. This can cause a depletion of oxygen in the bloodstream and/or poisoning, leading to rapid suffocation and death.

General Handling and Operation

All users must follow the CMNBTR policies for PPE when working with compressed gases and cryogenic liquids.

The figure below depicts a regulator attached to a cylinder



- Hand, eye, body and respiratory protection should be determined prior to the use of any compressed gasses.
- Cylinders with regulators usually have a number of valves, and individuals using the cylinders need to know the function of each valve before use.
- Use of safety glasses (preferably with a face shield) when handling and using compressed gases, especially when connecting and disconnecting compressed gas regulators and lines is recommended.
- All laboratory workers must be trained in proper handling of compressed gas cylinders and recorded by PI. Compressed gases must only be handled by experienced and properly trained individuals.
- Laboratory workers must have proper equipment for fitting and securing a cylinder, including valves, regulators, wrenches, tubing, straps, racks, chain and clamps.
- Cylinders must be kept in an upright position and must be secured with chains or straps to an immovable object.
- Small cylinders must not be kept in drawers or cabinets. They must be kept in an upright position and secured with a chain or strap.
- The cylinder's valve must be closed at all times, except when in use.
- Wrenches or other tools must not be used for opening and closing valves. If a valve is not working, have it inspected and fixed.
- Leave the valve protection cap in place until the cylinder is secured.
- Valve protection caps should remain in place until ready to withdraw gas or connected to a regulator or manifold.
- Do not force connections that do not fit.
- When extracting gas from a cylinder, increase the flow rate slowly and inspect the system for leaks.
- All compressed gas cylinders must have safety pressure relief valves.
- Use the cylinder valve for turning gas off, not the regulator.
- Never heat a cylinder to raise the pressure of the gas (this can defeat the safety mechanisms built in by the supplier).
- Safety relief devices in the valve or on the cylinder must be free from any indication of tampering.
- Laboratory workers must monitor for leaks and ensure proper labeling.
- All compressed gas cylinders must regularly be inspected for corrosion, pitting, cuts, gouges, digs, bulges, neck defects, general distortion.
- All compressed gas cylinders must have their contents and precautionary labeling clearly marked on their exteriors.
- Empty, damaged and surplus cylinders must not be stored in the laboratory.
- Never attempt to adapt fittings from one cylinder or regulator to another.
- Fittings or hoses must be compatible with the gas in the cylinder.
- Gases must never be transferred from one cylinder to another.
- Cylinders must not impede movement through isles or prevent egress in the event of an emergency.
- Never lubricate any part of the valve, cylinder, or attached equipment.
- Keep the cylinders in a dry, cool and well-ventilated area.

- Incompatible gas cylinders must be properly separated. Oxygen and flammable gas cylinders must be separated by a minimum of 20 feet.
- When using toxic or irritating gas, the valve should only be opened while the cylinder is in a working fume hood.
- Before removing a regulator from a cylinder, close the cylinder valve and release all pressure.
- Label all empty cylinders with tags so that everyone will know their status. Handle empty cylinders as carefully as full ones; residual pressure can be dangerous.

- **In the event of a fire, call 9-911 from a campus phone or 911 from a cell phone.**

Hazardous Gases

Hazardous gases include both toxic gases and gases that create fire hazard. Hazardous gases must be stored in vented cabinets, fume hoods, or specially designed vented equipment. Fuel cylinders should be stored in vented cabinets separate from oxygen cylinders.

Some examples of hazardous gases include: O_2, H_2, HCl, HF, H_2S, NH_3, NO, NO2, SO2, acetylene and halogen gases (Cl_2, Br_2, F_2).

Safety Tips

- Choose piping and fittings appropriate for the chemical and pressure used.
    - Do not use adaptors
    - Only use compatible regulators
- Before using a cylinder, verify that the correct gas is selected.
- When installing a cylinder check for leaks around the valve connections.
- When a cylinder is empty, close the valve, check for leaks, and remove the cylinder.
    - Securely recap the cylinder and attach a tag/sticker to identify the cylinder is empty

Pressure Regulators for Cylinders

- Use the appropriate regulator for the type of tank and gas being used.
- Do not use any oil, grease, mercury or soapy water on regulator valve.
- Check that the regulator is free of foreign objects.
- Relief valves must be vented to a laboratory chemical hood or other safe location.
- Never attempt to repair a gas leak when the system is still pressurized or venting gas.
- While a cylinder is not being used, the regulator must be removed.

Steps to open a cylinder

When opening the cylinder follow these steps:

1. Back off the pressure adjusting screw of the regulator to release spring force before opening the cylinder valve.
2. Open the valve slowly and only with the proper regulator in place.
3. Never leave pressure in a regulator when it is not in use.
4. Stand with the cylinder between yourself and the regulator (cylinder valve outlet facing away) when opening the cylinder valve.
    a. Acetylene or other flammable gas cylinder valves should not be opened more than ½ turns of the spindle, and preferably no more than ¾ of a turn. This reduces the risk of explosion and allows for the cylinder valve to be closed quickly cutting off the gas flow.
    b. Do not use acetylene at operating pressures above 15 psig.
    c. Oxygen cylinder valves must be opened all of the way during use.

Transportation and Storage of Cylinders

- Use proper PPE when transferring or moving cylinders
- Always inspect cylinders before transferring
- Before moving cylinders, regulators must be removed, valves must be closed and the cap must be securely in place.
- Only use an approved wheel cylinder carts for the transportation of cylinders. Never use carts for storage.
- When moving a cylinder on a wheeled cylinder cart, the cylinder must be secured to the cart with a chain or strap.
- Never drag, slide or roll a cylinder.
- Do not drop cylinders or strike them against each other or against other surfaces violently.
- Do not use the valve cover to lift cylinders; they could be damaged and become unattached.
- Always secure cylinders to structural supports that are permanently affixed to the floor, wall, or ceiling.
- It is permissible to store up to 3 capped cylinders together, however, if uncapped the cylinders should be secured individually.
- Do not secure cylinders near any heat source such as incubators, water baths, hot plates, or burners
- Never store cylinders in poorly ventilated rooms.
    - Because compressed gases and liquids rapidly displaces oxygen in a room, suffocation is a possibility in a poorly ventilated room
    - Oxygen cylinders opened in a poorly ventilated room can quickly enrich the atmosphere creating an atmosphere where a small spark can cause an explosion and a deadly fire

Preventing and Controlling Leaks

- Laboratory workers must check the cylinder's connections and hoses regularly for leaks.
- Convenient ways to check for leaks include flammable gas leak detectors (for flammable gases only) or a 50% glycerin in water solution. Bubble-

forming solutions and leak detectors are available commercially. **Never use a flame for leak detection**.

The following procedures must be used when a compressed gas cylinder leak cannot be remedied by simply tightening the valve:

- Attach a tag to the cylinder stating it is unserviceable.
- If the cylinder contains a **flammable, inert, or oxidizing gas**, remove it to an isolated area, away from possible ignition sources.
    - Allow it to remain isolated until the gas has discharged, making certain that appropriate warnings have been posted.
- If the gas is **corrosive**, remove the cylinder to an isolated, well-ventilated area. The stream of leaking gas should be directed into an appropriate neutralizing material.
- If the gas is **toxic**, remove the cylinder to an isolated, well-ventilated area, but only if this is possible while maintaining personal safety. It may be necessary to evacuate the facility.
- Notify the gas supplier and follow his/her instructions as to the return of the cylinder.
- If any risk of exposure exists, call the EH&S and evacuate the area before the tank is moved.
- For major leak, all laboratory workers must evacuate the laboratory immediately, close the doors and contact **EH&S**

APPENDIX E

Guidance for Writing Carcinogen, Mutagen, and Teratogen Procedures

Written procedures for work with carcinogens, mutagens, and teratogens shall include the following information, as a minimum.

1. **Chemical of concern.**
    a. What chemical will be used?
    b. Identify whether it is a carcinogen, a mutagen, or a teratogen.
    c. Are there other hazards associated with the chemical (i.e., corrosive, reactive, flammable, toxic, irritant)?

2. **Physical form of chemical.**
    a. Solid, liquid, or gas?
    b. Will the form change during process (solid placed in solution or liquid phasing into a vapor)?

3. **Quantity on-hand in the laboratory and the amount used in each procedure.**
    a. How much is present and how is it stored?
    b. How much will be used for each repetition of the process?

4. **Laboratory and specific location(s) in the lab where the chemical will be handled or used.**
    a. Where will it be measured, mixed, etc.?
    b. Where will the process in which it is used take place?
    c. Are these areas clearly marked?
    d. Is the laboratory posted?

5. **Administrative controls employed to limit exposure.**
    a. Will all lab workers be using/handling it?
    b. Will all lab workers be present when it is used/handled?

6. **Engineering controls employed to limit exposure**.
    a. Will the use/handling be done in a hood?
    b. Will the process take place in a hood?

7. **Personal protective equipment (PPE) employed to limit exposure.**
    a. Will lab workers be wearing gloves, goggles, face shield, etc.?
    b. Is the PPE on hand appropriate for this chemical?

8. **Laboratory security measures.**
    a. Are non-essential personnel barred from the lab when operations with this chemical take place?
    b. Is the storage location for the chemical secure?

9. **Medical surveillance.**
    a. Does an OSHA substance-specific standard regarding this chemical exist?

b. Has EH&S performed exposure monitoring that indicates surveillance is necessary?

10. Informed consent

a. Has every worker in the laboratory been made aware of all the hazards associated with this chemical?
b. Have all been trained regarding the necessity of the exposure control portions of this procedure and the potential consequences of failure to comply?
c. Is the training documented and acknowledged by signatures of the lab workers?

Include any other information or procedures specific to this chemical or laboratory that may have a bearing on the safety and health of lab workers.

Procedures for Working with Carcinogens, Mutagens, and Teratogens

- It is the responsibility of the lab workers to be aware of hazards associated with any chemical they use. Information is available from Material Safety Data Sheets found in _____.

- All new workers in the laboratory who will work with carcinogens, mutagens, and teratogens will be trained by one of the following people_____.

- For any chemical used in the laboratory, the lab worker is responsible for being aware of known or suspected hazards. For each known carcinogenic, mutagenic, or teratogenic chemical to be used, the lab worker should identify these and other hazards (i.e. corrosive, reactive, flammable, toxic, irritant) based on available SDS recommendations available in the laboratory.

- The lab worker should be aware of the physical form of the chemical and any potential phase changes during the experiment.

- The lab worker should be aware of the quantity on hand to be used.

- Opened containers of carcinogens, mutagens, and teratogens should be stored in the labeled area under the hood and used in the hood as indicated in the laboratory.

- Sealed containers of carcinogens, mutagens, and teratogens should be stored according to their hazards.

- Usage of these compounds should be limited to lab workers trained in their safe usage.

- Lab workers should wear Personal Protective Equipment (PPE) including, but not limited to gloves, lab coat, hair restraints, goggles, and any other PPE recommended by the SDS that is deemed appropriate.

- When working with hazardous chemicals, only group members should be in the lab. To prevent unauthorized usage of chemicals, access must be limited. Access to this lab can be acquired through _____.

- If OSHA monitoring is required, it should be performed by EH&S.

- Every lab worker is to receive training in the safe handling of hazardous chemicals and is to document this by signing an informed consent document.

If you have any questions, please ask _____.

APPENDIX F

Peroxide Forming Compounds

Acetal	Isopropanol
Acrylic acid	Isopropyl ether
Butadiene	Methyl acetylene
Chlorobutadiene (chloroprene)	Methyl cyclopentane
Chlorotrifluroethylene	Methyl methacrylate
Cumene	Methyl-isobutyl ketone
Cyclohexene	Potassium amide
Cyclooctene	Potassium metal
Cyclopentene	Sodium amide (Sodamide)
Diaactylene	Styrene
Dicyclopentadiene	Tetrafluoroethylene
Diethyl ether	Tetrahydrofuran
Diethylene glycol dimethyl ether (diglyme)	Tetrahydronaphthalene
Dioxane (*p*-dioxane)	Vinyl acetate
Divinyl acetylene	Vinyl chloride
Ethyl acrylate	Vinyl ethers
Ethylene glycol dimethyl ether (glyme)	Vinyl pyridine
Furan	Vinylidene chloride

It is recommended that peroxide forming chemicals be checked for the formation of peroxides or disposed of one year after opening. If peroxides are present, remove the peroxides or dispose of the chemical. These recommendations are from Stephen R. Rayburn, *The Foundations of Laboratory Safety*, 1990 and Jay A. Young, *Improving Safety in the Chemical Laboratory*, 1991.

Detection and Inhibition of Peroxides

Basic Protocols

Peroxide Test Strips

Commercially purchased test strips can be used for the detection of peroxide formation (follow the manufacturer's instructions)

Ferrous Thiocyanate Detection Method

Ferrous thiocyanate will detect hydro peroxides with the following test:

1. Mix a solution of 5 ml of 1 % ferrous ammonium sulfate, 0.5 ml of 1 N sulfuric acid and 0.5 ml of 0.1 N ammonium thiocyanate (if necessary decolorize with a trace of zinc dust)
2. Shake with an equal quantity of the solvent to be tested.
3. If peroxides are present, a red color will develop.

Potassium Iodide Detection Method

1. Add 1mL of a freshly prepared 10% solution of potassium iodide to 10 ml of ethyl ether in a 25 ml glass-stoppered cylinder of colorless glass protected from light (both components are clear).
2. A resulting yellow color indicates the presence of 0.005% peroxides.

Inhibition of Peroxides

1. Storage and handling under an inert atmosphere is a useful precaution.
2. Addition of 0.001 % hydroquinone, diphenylamine, polyhydroxyphenols, amino phenols or aryl amines may stabilize ethers and inhibit formation of peroxides.
3. Dowex-1© has been reported effective for inhibiting peroxide formation in ethyl ether.
4. 100 ppm of 1-naphthol is effective for peroxide inhibition in isopropyl ether.
5. Hydroquinone is effective for peroxide inhibition in Tetrahydrofuran.
6. Stannous chloride or ferrous sulfate are effective for peroxide inhibition in dioxane.

Please note that these methods are **BASIC** protocols. Should a researcher perform one of these methods, all safety precautions should be thoroughly researched.

Copied from Norman V. Seere in *Handbook of Lab Safety*

APPENDIX G

EXPOSURE ASSESSMENT

1. Assessment versus Monitoring - Exposure assessment is that portion of the exposure evaluation performed by the laboratory supervisor which involves a judgment based on materials being used, the manner of their use, and personal knowledge of the procedures being performed. Exposure monitoring is that portion of exposure evaluation performed by the laboratory safety officer, or other persons trained in industrial hygiene sampling techniques, which involves gathering data with direct or indirect reading instruments or equipment. Both methods evaluate employee exposure to some contaminant, with assessment being used as the screening method to determine if monitoring is necessary.

2. Assessment Procedures - An initial assessment of all laboratory procedures should be performed using the attached checklist. It may include such factors as the amounts and characteristics of the materials used, the frequency and duration of use, and the effectiveness of engineering controls and protective equipment. No exposure monitoring is indicated if laboratory employee exposures to substance(s) regulated by OSHA do not exceed the action level or PEL specified in 29 CFR 1910 subpart Z. Exposure monitoring would be indicated when there is reason to believe exposure levels for the substance(s) used in the areas indicated routinely exceed the action level or PEL.

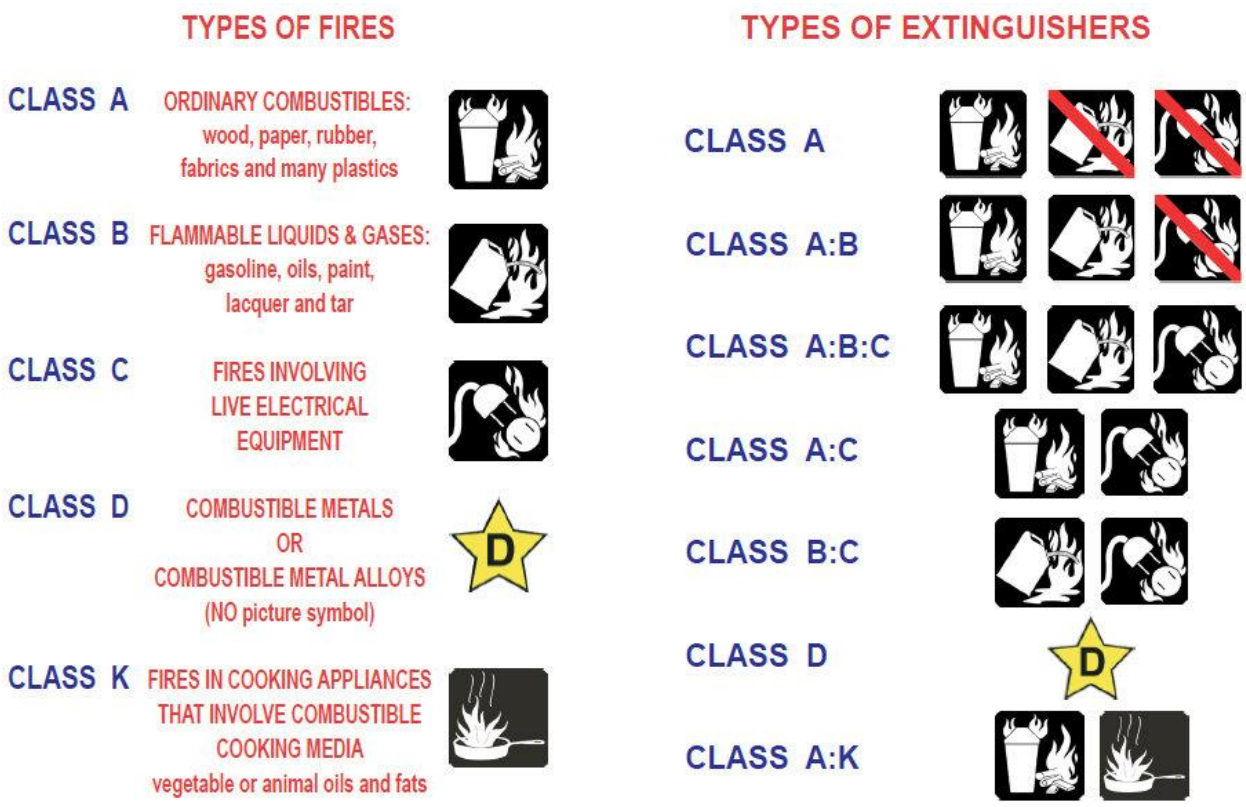
Exposure Assessment Checklist		Y	N
1	Is the procedure performed in a closed system?		
2	Can the procedure be performed inside a lab hood or other containment?		
3	Is the lab hood performing to established standards?		
4	If the substance is highly toxic, is it handled fewer than three times per week, for less than an hour per occurrence?		
5	Have all employees remained free of any of the signs or symptoms associated with overexposure to the substance?		
6	Does historical monitoring data indicate acceptable exposure levels?		
7	Does the written procedure address required personal protective equipment, emergency equipment and actions, work practices, and housekeeping?		
8	Is personal protective equipment appropriate to the hazard?		
If you answered 'NO' to any of these questions, contact the laboratory safety officer for further evaluation to be performed.			

APPENDIX H

Fire Safety

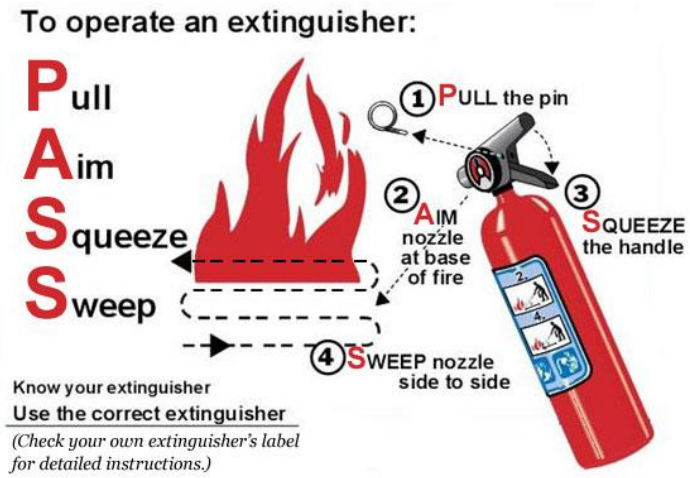
Classes of Fire Extinguishers

The class of a fire extinguisher tells what type of fire that extinguisher can be used on.



If the extinguisher is rated for multiple classes, it will work on all of the fire classes that are listed. For example, an ABC class fire extinguisher will work for any type of fire except Class D (metal) and K (cooking appliances) fires.

How to Use a Fire Extinguisher: PASS



To use a fire extinguisher, remember the acronym PASS:

Pull the pin
Aim at the base of the fire
Squeeze the handle
Sweep back and forth

Always start 8-10 feet away from the fire and walk towards the fire as you spray it with the extinguisher using a back and forth sweeping motion. If started too close this can cause the fire to spread. If the fire is not out by the time one gets to the fire, **LEAVE**. The fire is too big for the extinguisher to handle. Never attempt to put out a fire that is larger than a small trash can fire.

In the Event of a Fire – RACE

Rescue or Remove everyone from the lab
Activate the nearest alarm pull station
Confine the fire by closing lab door. If it's a hoof fire, close the sash, if possible
Evacuate. Leave lights on, follow the exit signs, stay low in smoky areas, and use stairs, not elevators

Flammable & Combustible Liquid Storage

Flammable liquids should always be stored in Underwriter Laboratory (UL) listed flammable storage cabinets and containers. Only keep small quantities (no more than 5 gallons) of combustibles in ordinary containers outside of flammable storage containers.

Open Flames

Never leave open flames unattended

Electrical Safety

Keep electrical equipment away from damp areas, such as sinks. Use ground fault protection and arrange equipment to avoid spills. Extensions cords are only to be used for a short period of time.

APPENDIX I

Fume Hoods: General Work Practices

The function of a fume hood is to protect scientists from hazardous vapors generated by laboratory experiments. However, simply conducting these experiments in the fume hood does not guarantee adequate protection. The fume hood must be used properly. These guidelines are to aid in optimizing the effectiveness of the fume hood.

In order for the fume hood to work effectively it is important to reduce obstructions in the fume hood. Air should be able flow across the working surface with minimum turbulence. This can be accomplished by:

- Minimizing the number of objects stored in the hood – keep at least 50% of the working surface clear.
- Always place containers and equipment at least six inches into the hood from the face.
- Place containers and equipment toward the sides of the hood to reduce obstruction of the exhaust slots.
- If possible, elevate equipment and containers two to three inches above the working surface using perforated or slotted shelving to minimize the disruption to the airflow.

Always check the airflow of the fume hood prior to use. Some hoods are equipped with airflow monitors that display a digital readout of the face velocity and/or beep or light up when the velocity is too low. If an airflow monitor is not installed, the airflow can be checked by holding a piece of light material (such as a tissue or chemwipe) at the bottom of the sash. The material will deflect inward if the hood is drawing air.

While working in the hood keep the sash at least 18 inches from the working surface to ensure maximum flow rate and to provide protection from potential chemical splashes or explosions. The sash should be kept closed when the fume hood is not in use.

Work at least 6 inches into the hood from the face to minimize the potential for fumes to escape. As a useful reminder, place a strip of tape at this six-inch limit.

Keep laboratory doors and windows closed and limit movement in front of the hood. Most laboratory ventilation systems are designed for labs to have all doors and windows closed. Open doors and windows can alter the air balance in the room and disrupt the airflow in the hood. Also, open doors and windows and traffic or movement in front of the hood can create turbulence resulting in vapors flowing out of the hood's interior.

Fume hoods are not the same as biosafety cabinets. Laboratory hoods and biosafety cabinets (or tissue culture hoods), although similar in appearance, are different devices. Biosafety cabinets are designed for protection against exposure to biological materials and for protection against contamination of biological experiments and typically offer no protection against chemical vapors.

APPENDIX J

PPE, Safety Equipment & Hygiene

Routes of Exposure

The four ways chemicals can enter the body are:

- Inhalation
- Ingestion
- Absorption
- Injection*

*For our purposes, the injection route of entry includes not only an actual injury to the skin caused by a sharp, but also through a pre-existing injury to the skin or through a cut injury (injection) that breaks the skin during a procedure.

The type of Personal Protective Equipment and Safety Equipment needed will need depend on the potential routes of exposure for the chemicals used.

Eye & Face protection

There are a number of PPE that can be used to protect the eyes and face from contamination and/or damage. Some examples of these PPEs are goggles, safety glasses, and face shields.

- Goggles are uses to prevent contamination of the eyes.
- Safety glasses also prevents contamination or damage of the eyes, however since it does not provide a seal around the eyes contamination is possible.
- Face shields are used to protect the entire face from splashes, damage, and contamination.

It is important to select the eye/face protection appropriate and rated for the work to be carried out.

Skin protection

In addition to the clothes and shoes worn all the time, additional protective clothing such as lab coats, lab aprons or chemical resistant protective suits and chemically resistant gloves are required to prevent skin contamination. Since protective suites are not worn in most labs appropriate clothing is required. Appropriate laboratory attire consists of pants, close toed shoes, etc. Clothes that leave large areas of skin bare, such as shorts, short skirts and sandals, should not be worn in the lab.

The hands are the most likely part of the body to become contaminated. When selecting gloves for use in the lab remember:

1. Not all gloves protect from all chemicals. Check to make sure the chemicals used will not degrade integrity of the gloves selected. Glove

manufacturers can provide assistance in determining which gloves will work for different chemicals. **Never wear latex gloves when handling solvents.**
2. Disposable gloves should be changed frequently. They should not be washed and reused.
3. Sometimes it may be necessary to wear more than one pair of gloves. For example, heavy gloves over Nitrile gloves when using large quantities of hazardous chemicals such as halogenated solvents.

For assistance in determining the best PPE to wear for the chemicals please consult the National Institute for Occupational Safety and Health (NIOSH) Guide to Chemical Protective Clothing (http://www.cdc.gov/niosh/ncpc/). To reduce the likelihood of skin contamination, please keep the laboratory clean. Do not leave behind chemical residues that will allow other people to become contaminated.

Ingestion Protection

To prevent accidental ingestion of chemicals:

- Wear gloves during all experimental procedures
- Wash hands after all procedures
- Never store food or beverages in the laboratory
- Never eat or drink in the laboratory

Inhalation Protection

To prevent inhalation of chemical gases, vapors, dusts or aerosols:

- Work in a fume hood. Make sure the fume hood is working properly before use and work at least six inches in from the edge of the hood to maximize the capture efficiency of the fume hood.
- Glove boxes are another way to prevent hazardous chemicals exposure.
- Wearing a respirator is the very last option to consider when providing inhalation protection.
    a. Before anyone can be approved to wear a respirator, they must satisfy two OSHA requirements:
        i. A medical evaluation to determine whether or not a person is physically capable of wearing a respirator
        ii. OSHA requires a fit-test evaluation to ensure that the respirator seals properly around the face and does not allow unfiltered air to leak in.
    b. Respirator filters are chemical specific. Care must be taken when selecting the cartridges for the respirator. The cartridges must be able to absorb the chemicals the user will be working with.

Emergency Showers & Eye Wash Stations

If there is an accident, two of the most important pieces of safety equipment found in a laboratory are the emergency shower and the eye wash station. If

contamination should occur over a large area of the body immediately go to the emergency shower, strip off any contaminated clothing, and stay under the water for at least 15 minutes.
An eye wash station is used to flush the eyes if they should become contaminated. Eyes should be flushed immediately after a contamination has occurred. The general rule is to flush the eyes with water for 15 minutes.

Trace Metals, Persistent and Bio-accumulative Toxic Compounds Threshold Limits				
Substance	**Limit in Mg/L**		**Substance**	**Limit in Mg/L**
Aldrin	0.14		Heptachlor (and its epoxide)	0.008
Antimony and/or antimony compounds	15		Hexachlorobenzene	0.13
Arsenic and/or arsenic compounds	5		Hexachlorobutadiene	0.5
Barium and/or barium compounds (excluding barite)	100		Hexachloroethane	3
Benzene	0.5		Kepone	2.1
Beryllium and/or beryllium compounds	0.75		Lead and/or lead compounds	5
Cadmium and/or cadmium compounds	1		Lindane	0.4
Carbon Tetrachloride	0.5		Mercury and/or mercury compounds	0.2
Chlordane	0.03		Methoxychlor	10
Chlorobenzene	100		Methyl ethyl ketone	200
Chloroform	6		Mirex	2.1
Chromium (VI) compounds	5		Molybdenum and/or molybdenum compounds	350
Chromium and/or chromium (III) compounds	5		Nickel and/or nickel compounds	20
Cobalt and/or cobalt compounds	80		Nitrobenzene	2
Copper and/or copper compounds	25		Pentachlorophenol	1.7
Cresol	200		Polychlorinated biphenyls (PCBs)	5
Cresol (-m)	200		Pyridine	5
Cresol (-o)	200		Selenium and/or selenium compounds	1
Cresol (-p)	200		Silver and/or silver compounds	5
D (2,4-)	10		Tetrachlorethylene	0.7
DDT, DDE, DDD	0.1		Thallium and/or thallium compounds	7
Dichlorobenzene (1,4-)	7.5		Toxaphene	0.5
Dichloroethane (1,2-)	0.5		TP(Silver) (2,4,5-)	1
Dichloroethylene (1,1-)	0.7		Trichloroethylene	0.5
Dichlorophenoxyacetic acid (2,4-)	10		Trichlorophenol (2,4,5-)	400
Dieldren	0.8		Trichlorophenol (2,4,6-)	2
Dinitrotoluene (2,4-)	0.13		Trichlorophenoxypropionic acid (2,4,5-)	1
Dioxin (2,3,7,8-TCDD)	0.001		Vanadium and/or vanadium compounds	24
Endrin	0.02		Vinyl chloride	0.2
Fluoride salts	180		Zinc and/or zinc compounds	250

Acknowledgement of P&P

I, _____, hereby acknowledge and declare that:
Print Name

I have read, understand, and agree to the policies and procedures outlined in the Center for Micro-, Nano-, and Bio-Technology Research (CMNBTR) Laboratory Manual that I received.

I am aware that the Biosafety Manual, Radiation Safety Manual, and the Laboratory Hygiene Plan for Tennessee State University are available to me online. It is my responsibility to familiarize myself with these policies.

I agree to conduct my activities in accordance with CMNBTR's policies and understand that breaching these standards may result in disciplinary actions up to and including termination of laboratory access.

Signed: _____ Date: _____