LABORATORY SAFETY MANUAL

CENTRAL & WATERFRONT CAMPUS CONTACTS

EMERGENCY

Emergency Services	503-494-4444	
OHSU Public Safety	503-494-7744	
OHSU Paging System	503-494-4799	

Research Safety Program

Debra Brickey, PhD CBSP	503-382-7543	cell
Research Safety Manager, OHSU Biosafety Officer	16709	pager
Benjamin A. Smith, MS	503-494-2580	office
Marquam Hill Biosafety Officer	16411	pager
April Karr, BS	503-418-2247	office
Chemical Safety Officer/		
Laboratory Safety Officer		

ENVIRONMENTAL HEALTH & RADIATION SAFETY

EHRS Office	503-494-7795	
John Burnham, PhD	503-494-2574	office
Director, EHRS	14603	pager
Sean Akers	503-494-0425	office
Hazardous Materials Technician	12516	pager
Al Castellane	503-494-2583	office
Radiation Safety Officer	11329	pager
Rupinder Kaur, MS	503-494-2578	office
Health Physicist	11304	pager

FACILITIES SERVICES

Facilities & Real Estate Office	503-494-2234
Environmental Services	503-494-8707

MEDICAL SERVICES

Emergency Department	503-494-8116
Employee Health	503-494-5271
Student Health	

SHIPPING/RECEIVING

Dock 4 Receiving	503-494-4869
Main Shipping Office (near Dock 4)	503-494-7380

WEST CAMPUS CONTACTS

EMERGENCY		
Emergency Services	9-911	
OHSU Public Safety	503-494-7744	
ONPRC Guard Station	503-533-2484	
Research Safety Program		
West Campus RSP Office	503-690-5390	
Jennifer Sinclair, Administrative Assistant		
Debra Brickey, PhD CBSP	503-382-7543	office
Research Safety Manager, OHSU Biosafety Officer	16709	pager
Dan Toyooka	503-690-5339	office
West Campus Safety Specialist	503-993-8996	pager
Jeffrey Hietanen, BS	503-690-5376	office
Industrial Hygienist	503-790-3182	pager
Harjinder Sardar, PhD	503-690-5368	office
West Campus Biosafety Officer	503-202-5352	pager
Susan Clary, MS	503-690-5310	office
Biosafety Specialist	503-202-3873	pager
FACILITIES SERVICES		
ONPRC Facilities/Properties	503-690-5249	
OGI Facilities & Real Estate	503-748-1121	
MEDICAL SERVICES		
Occupational Health Nurse	503-629-4031	
Cascade Occupational Medicine	503-726-1021	
Providence St. Vincent Med. Ctr.	503-216-7000	
Infectious Disease Consultants		
SHIPPING/RECEIVING		
ONPRC Research Stores	503-690-5256	
Logistics Manager	503-748-1046	office

TABLE OF CONTENTS

I. INTRODUCTION

1.1 Purpose

Oregon Health and Science University (OHSU) is committed to providing a safe and healthy workplace, and to meeting its obligations under the Oregon Occupational Safety and Health Administration (OSHA), "Occupational Exposures to Hazardous Chemicals in the Laboratory" (29 CFR 1910.1450 and OAR 437-02-391). Included in OSHA's standard is the requirement that all employers develop and implement a Chemical Hygiene Plan which sets forth procedures, equipment, personal protective equipment and work practices that are capable of protecting employees from the health hazards presented by hazardous chemicals used in that particular workplace. The following is OHSU's chemical hygiene plan in conformance with these requirements.

1.2 Scope

This Chemical Hygiene Plan applies to all employees and students engaged in laboratory use of hazardous substances, where there is the potential for employee exposure to hazardous materials. It does not apply to those working outside the laboratory setting. This plan was developed by the OHSU Research Safety Program (RSP) and with input Environmental Health and Radiation Safety (EHRS) Office and the Central & Waterfront Campus and West Campus safety committees.

Individuals working with radioactive materials should refer to the Radiation Safety Policy and Procedures manual. Those working with biological agents should refer to the OHSU Biosafety Manual. This laboratory safety manual, the biosafety manual and radiation safety policies are also available on the OHSU intranet at http://ozone.ohsu.edu/ehrs/.

1.3 Definitions

Action level - An action level is a concentration designated in 29 CFR part 1910 for a specific substance, calculated as an eight-hour time weighted average (TWA), which initiates certain required activities such as exposure monitoring and medical surveillance.

Hazardous material - A hazardous material is defined as a chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that adverse acute or chronic health effects may occur in exposed employees.

HEPA - A HEPA filter is a high efficiency particulate air filter that prevents small particles from passing through to the other side of the filter. This type of filter is 99.97% efficient at 0.3 microns.

Incidental Spill - An incidental spill is a release of a chemical that does not present an imminent danger to people, property or the environment and may be easily controlled and contained by the worker.

Laboratory - A laboratory is a place where small quantities of hazardous chemicals are utilized on a non-production level.

Laboratory scale - Laboratory scale applies to work in which the containers involved with substances can be manipulated by one person. This category excludes commercial production of materials.

LD_{50} - Concentration at which half the population of the test organisms experience a lethal dose as a result of exposure to a chemical. This term is commonly used in toxicology findings.

Permissible Exposure Limit (PEL) - The permissible exposure limit is the maximum exposure level, averaged over an 8-hour work day that is allowed in a worker's breathing zone. The allowable employee exposure to hazardous chemicals is to be limited to the specific PEL for a chemical as cited in Oregon OSHA 29 CFR 1910.

Personal Protective Equipment (PPE) - PPE are devices that are used or worn to reduce the potential of worker injury or exposure to hazardous substances. Common examples of laboratory associated PPE include lab coat, eye protection, and gloves.

II. HAZARDOUS MATERIALS PROGRAM

Every OHSU student and employee who handles potentially hazardous materials is expected to utilize the procedures detailed in the appropriate document and to develop safe personal hazardous material handling habits aimed at the minimization of exposure to themselves and to their co-workers. Workers have the right to not perform a task if the task will put them in danger. Employers must provide adequate training, personal protective equipment, and supervision to enable the employee to perform the task in a safe manner.

2.1 Responsibilities

The responsibility for proper hazardous materials management rests at all levels of the organization, as follows:

OHSU Research Integrity Office (ORIO) - This office provides administrative support and resources for the development and implementation of laboratory safety, biosafety, and radiation safety policies and procedures.

Research Safety Program (RSP) - This program, with support from the Department of Environmental Health and Radiation Safety (EHRS), works with the campus community to develop and implement appropriate laboratory safety, biosafety, and radiation safety policies and procedures; sees that appropriate assessments are conducted as necessary; provides health and safety training to all students and employees; maintains required record keeping and documentation related to safety compliance, including annually reviewing this Laboratory Safety Manual; acts as a consultant for occupational health and safety-related concerns on campus; and seeks ways to improve the hazardous materials

management program. RSP and EHRS also facilitate each campus' safety committee, which meet monthly and include representation from many departments where hazardous substances are used.

Department Heads and Principal Investigators - These positions are ultimately responsible for approving safe operating procedures for each laboratory; setting a good example in following and enforcing safe work practices themselves; ensuring students and staff are adequately trained to perform the tasks assigned; providing necessary safety and personal protective equipment to researchers in their labs; and ensuring faulty equipment is repaired or replaced as necessary.

Laboratory and Area Supervisors - These positions have overall responsibility for hazardous materials management in the laboratory, including ensuring that students and employees know and follow appropriate chemical hygiene, biosafety, and radiation safety procedures; attend safety training classes; and that appropriate personal protective equipment is available, in good working order, and worn when needed. Supervisors set a good example by wearing appropriate personal protective equipment and observing all safe lab practices and procedures.

Laboratory Employees and Students - These positions are responsible for planning and conducting each operation following appropriate safety procedures. All students and employees, who work in labs, must take the Big Brain General Safety and Laboratory Safety On-Line courses available on the O-Zone intranet at https://bigbrain.ohsu.edu/ .

2.2 Information and Training

All students and employees will be informed of the hazards presented in the laboratory. Each worker shall receive health and safety training at the time of initial assignment, prior to assignments involving new potential exposure situations, and at least every 3 years. This training shall include methods of detecting the presence of hazardous materials, physical and health hazards in the laboratory, and measures employees can take to protect themselves from these hazards, including appropriate use of personal protective equipment. Students and employees must have access to this Laboratory Safety Manual.

Training resources - Additional training resources are available in a wide variety of areas including: chemical handling and storage, radiation safety, fire/life safety evaluation, spill control, emergency response, bloodborne pathogen exposure prevention, laboratory safety, chemical, biological, and radioactive waste management, ergonomics, biosafety, biological safety cabinet function and operation, laser safety, CPR, first aid, and fire extinguisher training.

Please contact your campus RSP/EHRS office for further information regarding a specific program or procedure.

2.3 Prior Approval

Laboratory personnel shall seek prior approval from the principal investigator before purchasing or working with highly toxic agents, or any time a new lab procedure is employed. Prior approval is also required in any of the following situations:

Toxic or highly flammable gases - Before beginning any research with acutely toxic or flammable compressed gases (arsine, chlorine, carbon monoxide, etc.), investigators must consult with the Research Safety Program. See Appendix B for more information on compressed gas cylinders.

High exposure - Researchers must contact the Research Safety Program anytime it is possible that an exposure could approach hazardous levels (lower explosive limit, permissible exposure limit, etc.). At no time shall students or employees be exposed to hazardous chemicals such that their health or safety is compromised. See Section IV of this document for methods to control exposures.

Working alone - Extremely hazardous operations should be performed during a time when at least two people are present in the laboratory. Examples include working around exposed high voltages, unenclosed class 4 lasers, acutely toxic gases, extremely reactive chemicals, or experiments requiring very high pressures or vacuums. If a researcher must work alone at any time, he or she should obtain prior approval from the principal investigator or supervisor.

Unattended operations - Contact EHRS if a potentially hazardous operation must be left unattended. When hazardous laboratory operations are performed which will be unattended by laboratory personnel (continuous operations, overnight reactions, etc.), the following procedures must be employed:

Leave the lights on in the lab.
Post a sign on the lab door saying a procedure is being run unattended overnight and giving your name and a telephone number where you can be reached in case of emergency.
Use secondary containment around any liquids to contain spills when possible.
Take precautions in case of equipment failure or interruption of utility service during the unattended operation (loss of water pressure, electricity, etc.). For example, use over-temperature controls if heating materials.

Prior approval from the applicable committee may also be necessary before working with certain biological or radioactive materials. Refer to the Biosafety Manual or for links to a particular committee's website. For more information concerning biological research go to the Research Development and Administration web page at http://www.ohsu.edu/research/rda/. For research involving radioactive materials go to http://ozone.ohsu.edu/ehrs/mh/pages/rad/rad_safety_1.shtml for information regarding licensing, training, and dosimetry.

2.4 Medical Consultations and Examinations

The opportunity to receive medical attention is available to all students and employees who work with hazardous materials in the laboratory. Biological monitoring is generally used as a screening tool for early signs of disease due to chemical or biological agent exposure. However, because biological monitoring identifies medical conditions after the exposure has occurred, it is only a secondary measure of prevention. The primary goal is to minimize exposure to hazardous materials before they occur. There are two kinds of exposure-related medical consultations: baseline monitoring and medical monitoring after exposure.

Baseline monitoring - may be conducted before exposure occurs as determined by EHRS, in order to establish a baseline against which future medical tests may be compared. Baseline eye exams are required for researchers working with class 3b or 4 lasers. The cost of monitoring will be borne by the principal investigator or cost center responsible for the researcher's support.

Biological monitoring for chemical exposure - will be conducted as deemed necessary by Research Safety. Biological monitoring is not routinely conducted at OHSU. Students and employees should notify RSP and seek medical attention if they experience symptoms associated with chemical exposure or anytime they are concerned about their exposure.

Employees and students who are required to wear respirators as part of their work at OHSU must be fit-tested as part of the respiratory protection program. The use of respirators in laboratories at OHSU is rarely necessary. Refer to the OHSU respiratory protection program, available through RSP, for more details.

Criteria for Medical Evaluation - All OHSU students and employees who work with hazardous materials will have an opportunity to receive medical attention, including any follow-up examinations that the examining physician determines to be necessary under the following circumstances:

- Whenever an employee develops signs or symptoms associated with a hazardous material to which the employee may have been exposed in the laboratory.
- Where exposure monitoring reveals an exposure level routinely above the action level (or in the absence of an action level, the PEL) for an OSHA regulated substance for which there are exposure monitoring and medical surveillance requirements, medical surveillance shall be established for the affected employee as prescribed by the particular standard.
- Whenever an event takes place in the work area such as a spill, leak, explosion, injection of a hazardous substance or other occurrence resulting in the likelihood of a hazardous exposure, the affected employee shall be provided an opportunity for a confidential medical consultation. Such consultation shall be provided for the purpose of determining the need for a medical examination.

Medical Services - All medical examinations and consultation shall be performed by or under the direct supervision of a licensed health care provider and shall be provided without cost to the employee, without loss of pay and at a reasonable time and place. See Medical Services under Campus Contacts for the designated campus health care providers.

Information for Attending Licensed Health Care Provider - The employer shall provide the following information to the health care provider:

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

Written Report from Licensed Health Care Provider - The attending health care provider will provide a confidential written report that shall include the following:

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

The confidential written opinion shall not reveal specific findings of diagnoses unrelated to the potential occupational exposure.

Final Documentation and Distribution of Written Report - The attending physician will provide the employee and employer with a copy of the written medical report. The employer will notify the employee's supervisor of the results of the medical consultation or examination. OHSU will keep a file of all written medical reports concerning laboratory employees. Medical conditions will be accommodated as provided under state and federal regulations.

III. STANDARD OPERATING PROCEDURES FOR WORKING WITH HAZARDOUS MATERIALS

3.1 Procurement of Hazardous Materials

The decision to procure a hazardous material is a commitment to handle and use the material properly from initial ordering to ultimate disposal often referred to as 'cradle to grave' by hazardous materials professionals. Principal investigators should carefully review purchase requisitions involving hazardous materials.

Purchasing - Before ordering new materials, review the Material Safety Data Sheet (MSDS) for the product and become familiar with the physical and toxicological properties of the material. If an alternative is possible, use the least hazardous material. MSDS's are available from the products manufacturer. See Appendix G for additional MSDS websites. A hard-copy of the MSDS for each hazardous chemical must be maintained in a location easily accessible to all workers.

Order the smallest quantity necessary to do the job. Before ordering any materials, work out the experimental design on paper, then conduct a small test of the proposed experiment. Remember that the disposal of hazardous materials left over at the end of the experiment can be expensive. It is highly recommended that materials be dated upon receipt in the laboratory.

Gifts - Notify RSP before accepting any gifts or donations of hazardous materials. In some cases, acceptance of such gifts can become a liability for the institution, particularly if subsequent disposal costs are high. All gifts or donations of hazardous chemicals must be preceded by a copy of the MSDS. ~~Lab staff should send a copy of the MSDS to the EHRS Department.~~

Material Safety Data Sheets (MSDSs) - Labs shall keep a copy of MSDSs in the laboratory where these chemicals are utilized. Many MSDSs are also available by searching the internet, but these may become inaccessible if electrical power is interrupted.

3.2 Hazardous Material Handling and Work Practices

Because all chemical, biological, or radioactive materials inherently present hazards under certain conditions, exposure to all hazardous substances shall be minimized. General precautions to be followed for the handling and use of chemicals are listed below and are discussed in detail in the Big Brain on-line Laboratory Safety Training course presented by RSP.

Minimize Risk - Risk determinations should be conservative in nature. One should assume that any mixture will be at least as toxic as its most toxic component and that all substances of unknown toxicity are toxic. Even for substances of no known significant hazard, exposure should be minimized.

Consult MSDSs - Students and employees should consult MSDSs and other reference material as necessary to become familiar with the symptoms of exposure for the chemicals with which they work, and the precautions necessary to prevent exposure. EHRS staff is also available as a resource on chemical toxicology and appropriate work practices for specific materials. See Appendix G for a list of MSDS web sites.

Limit Exposure - In all cases of chemical exposure, none of the established occupational exposure limits shall be exceeded. These limits are not expected to be exceeded so long as hazardous materials are dispensed and used inside a chemical fume hood or biosafety cabinet as appropriate, safe laboratory procedures are followed, and appropriate personnel protective equipment is worn. If there is any question as to an individual's exposure level, EHRS RSP/EHRS may conduct personal environmental monitoring if deemed necessary.

Wash Hands - All students and employees must remove their gloves and wash their hands prior to leaving the laboratory. In addition, students and employees should wash their hands after removing gloves and before eating, drinking, handling contact lenses, or applying cosmetics.

No Mouth Pipetting - Mouth suction for pipetting or starting a siphon is prohibited. Use mechanical suction devices.

No Food or Beverages - Eating, drinking, smoking, gum chewing, or application of cosmetics are prohibited in areas where laboratory chemicals are present. Food and beverages may not be stored in lab areas, including areas used to store lab samples and/or materials. All PPE shall be removed and hands washed before eating or drinking.

Dress - Long hair and loose-fitting clothing shall be confined close to the body to avoid being contaminated with chemicals, caught in moving machine/equipment parts, or exposed to flames. Appropriate personal protective clothing must be worn when handling hazardous chemical, biological or radioactive agents. It is strongly recommended that laboratory personnel wear long pants and closed toe shoes.

Chemical Fume Hoods - Experiments, procedures and equipment that could produce hazardous aerosols, fumes or gases must be confined to a chemical fume hood or glove box. Use only those chemicals appropriate for the ventilation system. Chemical fume hoods will be tested and certified annually by RSP. Any chemical fume hoods which fail will be taken out of service or placed on restricted use until repaired.

Compressed Gas Cylinders - Always keep cylinders of compressed gases secured to the wall or a sturdy table with chains or safety straps. Small cylinders should have double chains or stored in a cart specifically designed for them. Store cylinders upright and not on their sides. Keep flammable compressed gases at least 25 feet away from oxidizers, except during use. Maintain the cap on the cylinder head when not attached to a regulator. Make sure the regulator is compatible for the type of gas. Move cylinders by chaining to a cart. Do not force fittings. Check for leaking connections using a bubble solution. See Appendix B for more information on compressed gas cylinders.

Lab Equipment - Personnel should keep their work areas clean and uncluttered. All chemicals and equipment must be properly labeled. At the completion of each workday or operation, the work area should be thoroughly cleaned and all equipment properly cleaned and stored.

Lab Glassware - All glassware will be handled and stored with care to minimize breakage. Broken glassware must be immediately disposed of in a broken glass container. Full broken glassware boxes must be sealed, labeled, and placed in an area for pick up by Custodial Services. All glass apparatus under high vacuum shall be shielded to contain chemicals and glass fragments, should implosion occur. Use only heavy grade, designated glassware in the autoclaves.

3.3 Storage of Hazardous Materials

Hazardous Materials shall be immediately moved to their designated storage area upon receipt. Breakable containers shall be placed in secondary containment during transportation to prevent spills. Hazardous materials shall not be stored on the floor. Large bottles and other heavy containers should be stored between shoulder and knee height to prevent injuries from lifting. Hazardous materials should not be stored above head height.

Secondary Containment - All hazardous liquids shall be stored in secondary containment to prevent spills. Ensure that the secondary container is compatible with the substance it is meant to hold. For example, acid-resistant trays (not metal) shall be placed under bottles of mineral acids; glass containers shall not be used to store hydrofluoric acid.

Separate Incompatibles - Refer to the label and MSDS before storing a hazardous material. Do not mix incompatible groups of chemicals in the same storage area unless separated by distinct secondary containers. Refer to Appendix D for a chart of chemical incompatibilities. Hazardous chemicals should be stored in the following groups:

- Acids (in acid storage cabinet)
- Air-sensitive chemicals (store under nitrogen)
- Bases (in separate storage cabinet or secondary container)
- Cryogenic liquids (well-ventilated area, where they can expand)

- Explosive materials (shielded storage area)
- Flammable or combustible liquids (in flammable storage cabinet)
- Flammable gases (in ventilated gas cabinet)
- Flammable solids (appropriate fire extinguishing material nearby)
- Lachrymators (keep refrigerated or in ventilated cabinet)
- Other liquids (labeled shelves, in secondary containers)
- Other solids (labeled shelves)
- Oxidizing gases (separate from flammables)
- Toxic gases (in continuously ventilated cabinet with emergency power)
- Water-sensitive chemicals (keep in a desiccator box)

Do not store incompatible materials close to each other. Secondary containment may be used to segregate different classes of materials. Make sure segregated areas are labeled.

Flammables - If any one room has more than ten gallons of flammable liquids (flash point below 100°F/37.8°C), the liquids must be kept inside a flammable liquid storage cabinet. If refrigeration is necessary, flammable materials must be kept in an explosion-proof refrigerator.

Limited Quantities - Storage of hazardous materials at the lab bench or other work areas shall be limited to those amounts necessary for one day's operation, keeping the total amount as small as practical. The container size should be the minimum convenient. Hazardous materials in the workplace should not be unnecessarily exposed to sunlight or heat (i.e., keep off the window sill).

Inspection - Containers should be examined periodically by lab workers. The inspection should determine whether any corrosion, deterioration, or damage have occurred as a result of leaking materials. Leaking or damaged containers must be removed or replaced immediately. Materials should not be kept past the intended shelf life for the product. Contact EHRS for assistance with disposal of hazardous materials.

3.4 Labeling of Materials

The need to label hazardous materials in laboratories should be based upon a practical risk assessment further motivated by good laboratory practice and technique. The ultimate objective is to provide a consistent and reasonable means of communicating chemical hazards to employees. This is for the protection of any personnel who may come into contact with the contents (i.e., lab workers, janitorial staff, hazardous materials handlers, etc.).

Labels on incoming (primary) containers of hazardous chemicals are not to be removed or defaced. The date the material is received should be clearly indicated on the outside of the container.

All secondary containers should be labeled in such a way that all workers in the laboratory can easily identify their contents. All secondary containers containing potentially hazardous chemicals that may represent a significant risk must be labeled with both the name of the material and the characteristic(s) that make the chemical hazardous (e.g. flammable, toxic/poison, radioactive, corrosive, etc.). It is also suggested that secondary container labels include such information as the preparer's name, the date prepared, and any special handling or storage requirements.

Small containers that are difficult to label (i.e., microcentrifuge tubes, small vials, etc.) may be stored unlabeled as long as they are maintained within a container labeled with the above information.

3.5 Personal Protective Equipment

Common examples of Personal Protective Equipment (PPE) utilized in the laboratory include lab coat, eye protection, and gloves. The selection of PPE shall be based upon risk to the worker. The employee's supervisor is responsible for ensuring proper PPE is being worn. RSP can assist with questions regarding PPE selection.

Eye and Face Protection - Eye protection is required for all personnel and any visitors whose eyes may be exposed to chemical, biological, or physical hazards. It is the supervisor's responsibility to ensure that adequate personal protective equipment is worn when necessary. Any PPE designated for eye and face protection should meet the requirements listed in ANSI Z87.1. General eye and face protective designs include:

- Safety glasses designed to protect against flying particulates.
- Safety goggles designed for protection against fumes, splashes, mists, or spray exposure to the eyes.
- Face shields designed to protect against exposures to the face.

Face shields should not be used as a substitute for eye protection and it may be necessary to provide both means of protection.

Hand and Body Protection - Hand and body protection is required when working with materials that can cause a significant exposure through skin contact. Appropriate gloves, lab coats, and other personal protection shall be selected to meet the needs of the specific work environment. General requirements for hand and body protection include the following:

Lab Coats - Lab coats shall be worn by personnel working in any area where chemical, biological or radioactive materials are routinely used or stored. Lab coats shall be removed when exiting the work area and removed immediately if grossly contaminated with hazardous materials. Lab coats shall never be taken home to be laundered. Each department should have a procedure established for lab coat laundry service.

Gloves - Gloves are required to protect the hands and arms from thermal burns, cuts, or biological/radioactive/chemical exposure that may result in absorption through the skin or reaction on the surface of the skin. Glove materials must be chosen with the specific tasks and agents used in mind (type of material, thickness, permeation rate, and degradation rate). Gloves should be inspected for defects or tears before and after each use unless discarded. Always wash hands after removing gloves. Latex gloves are not recommended for protection against many hazardous chemicals because this material does not provide a good barrier (i.e. Ethidium bromide) and because of the risk of developing an allergic reaction. See Appendix C for additional information on glove selection.

Foot Protection - Closed toe shoes shall be worn when working in areas where hazardous materials are being utilized.

Respirators - Chemical fume hoods are normally sufficient to prevent the need for respirators. In certain situations where engineering controls cannot effectively control the amount of air contaminants within the work environment, personnel may be required to wear respiratory protective equipment. However, this is not a desirable situation. Personnel designated to use respiratory equipment must first have appropriate medical approvals and training. Before wearing any respirator, contact RSP/EHRS for selection advice and fit testing.

3.6 Highly Toxic Substances

The following section applies to especially toxic substances that have high acute or chronic toxicity, and chemicals of unknown toxicity. These are defined as follows:

Chemicals with **high acute toxicity** are those that can cause damage after a single exposure or short term exposure. The immediate toxic effect can range from severe tissue irritation to death. Examples are cyanide compounds, >20% hydrofluoric acid, and compressed toxic gases such as arsine. In addition, any solid materials with an LD_{50} less than 50 mg/kg body weight, or volatile materials with an LD_{50} less than 500 mg/kg may be considered to have high acute toxicity.

Chemicals exhibiting **high chronic toxicity** are those which can cause serious damage after repeated exposure or exposure over a long period of time. These include, but are not limited to, embryotoxins and teratogens, such as mercury and ethylene oxide; mutagens such as ethidium bromide; chronic internal organ toxins such as chlorinated organic solvents; and known or suspect carcinogens; such as benzene and formaldehyde. See the MSDS for a description of a material's toxicity.

Also included are chemicals of **unknown toxicity**, which should be handled as if they were highly toxic.

Isolated Storage - Store highly toxic materials in a secured, designated area in the lab. Designated areas must be labeled with appropriate warning notices. Keep highly toxic materials in unbreakable secondary containers. Do not store highly toxic chemicals on open shelves or countertops.

Chemical Fume Hoods - Chemical fume hood performance is checked annually and by request. Inadequately functioning hoods will be labeled as such and should not be used. If a chemical fume hood in your work area alarms repeatedly or otherwise does not seem to be functioning properly, contact RSP immediately. Do not use the hood until it has been inspected and repaired if necessary. When working with carcinogens, dioxins, toxic gases or other highly toxic materials, an enclosed glove box with exhaust ventilation outside the building will provide the highest measure of protection.

Spills - In the event of an uncontrolled or significant spill, exit the area immediately and contact appropriate personnel on the Campus Contact list. For small or incidental spills that require assistance, contact RSP/EHRS directly. An incidental spill is one that does not present an imminent danger to people, property, or the environment, and may be easily controlled or contained by the worker. Laboratory personnel may manage small or incidental spills where the hazards are identified and appropriate precautions are taken to avoid exposure. Laboratory personnel shall receive training in spill cleanup before attempting to clean up any spills.

Do Not Work Alone - Two people should always be present when working with highly toxic chemicals.

Equipment Filters - Protect vacuum pumps from contamination by using charcoal filters, scrubbers or high efficiency particulate air (HEPA) filters. Vent the exhaust to a chemical fume hood.

Cleaning - Decontaminate work surfaces and equipment using appropriate cleaning products after completing procedures. Place used towels in a compatible container, secure, and dispose of appropriately. For powders, use a wet mop or vacuum with a HEPA filter for cleanup. Dry cleaning methods, such as sweeping, are not allowed since they will disperse the powder, increasing airborne exposure. Protect lab benches and hoods by lining the bench top with dry, absorbent, plastic-backed paper. Change this covering frequently. Remember, items such as pump oil may become contaminated during the experimental process.

Pregnancy - MSDS's sometimes provide information regarding reproductive hazards, however the data regarding numerous potentially hazardous materials is incomplete. Employees who are pregnant, planning to become pregnant, or concerned about reproductive hazards should contact EHRS/RSP.

IV. CONTROL MEASURES

4.1 Housekeeping and Waste Disposal

Each researcher is directly responsible for the cleanliness of his or her work space, and jointly responsible for common areas of the laboratory. OHSU's custodial staff is only responsible for emptying the trash, sweeping and mopping the floors, and refilling paper towel dispensers. Lab occupants are responsible for routine cleanliness. The following procedures apply to laboratory housekeeping:

Benches - Lab benches shall be kept clear of equipment and materials except those necessary for the work currently being performed.

Emergency equipment - Do not store material in front of emergency equipment. All floors, aisles, exits, fire extinguishing equipment, eyewashes, showers, electrical panels and other emergency equipment must remain unobstructed.

Cleaning - The work area must be cleaned at the end of each operation and all apparatus should be thoroughly cleaned upon completion of usage.

Spills - All spills on lab benches or floors shall be immediately cleaned and properly disposed of. A spill kit should be readily accessible to the laboratory. For uncontrolled or significant spills, contact Public Safety at 503-49**4-4444** at the Central & Waterfront Campus or the posted emergency contacts at the West Campus.

Waste - All hazardous materials must be disposed of in accordance with local, state, and federal regulations. For chemical waste disposal, see Appendix E. For biological waste disposal, see the Biosafety

Manual for information on appropriate waste management or Appendix F. For radioactive waste disposal see the radioactive materials policy at the corresponding campus.

Moving or Vacating - When a laboratory is vacated or the principal investigator leaves the University, RSP must be contacted prior to final checkout. See Appendix H for details.

4.2 Exposure Control Measures

Chemical Fume Hoods

A chemical fume hood is a protective device used for manipulations that may result in the release of toxic chemical gases, vapors, dust, or aerosols. Chemical fume hoods are designed to prevent or minimize the escape of air contaminants from the inside of the hood to the general laboratory area. Chemical manipulations are conducted inside the enclosure without insertion of any portion of the employee's body other than protected hands and arms. Exhaust air from chemical fume hoods is not recirculated and is typically vented, unfiltered through the top of the building using a dedicated chemical exhaust system. A fume hood is used for all chemical manipulations, with the following possible exceptions:

- Water-based solutions of salts, dilute acids, bases, or other reagents;
- Very low volatility liquids or non-friable solids;
- Closed systems that do not allow significant escape into the laboratory environment;
- Extremely small quantities of otherwise problematic chemicals.

Safe Work Practices for Chemical Fume Hoods –

- Always confirm adequate hood performance before use.
- Perform all work a minimum of 4 inches inside the hood.
- Keep the hood closed at all times except when adjustments within the hood are being made. This also minimizes energy use for the building.
- Keep your head and body out of the hood when chemicals are in use.
- Substitute less hazardous chemicals whenever possible.
- Be sure all paper towels, weigh papers, etc. do not get sucked up into the hood. Blocked hood ducts reduce air flow and are expensive to repair.
- Chemical fume hoods should not be used as a chemical storage area. Use a ventilated chemical storage cabinet when necessary.
- Keep items stored in hoods to an absolute minimum and do not allow them to block vents or airflow.
- Never intentionally evaporate materials in the chemical fume hood as this may be in violation of Clean Air Quality Laws. If the procedure requires solvent evaporation, contact EHRS. Always keep waste storage bottles capped when not in use.
- Chemical fume hoods should not be used as a chemical storage area. Use a ventilated chemical storage cabinet when necessary.

Chemical Fume Hoods and Working with Extremely Hazardous Chemicals - In specialized cases when work with extremely hazardous chemicals or chemical processes must be conducted in a fume hood; the hood's location should be designated as a controlled area with restricted access. High strength barriers

coupled with remote handling devices may be necessary for safe use of extremely shock sensitive or reactive chemicals. Consult with EHRS before the initial use of such chemicals or hazardous processes.

Biosafety Cabinets

Biosafety cabinets (BSCs) are available in three general types (Class I, II, III), although Class I BSCs are no longer manufactured on a regular basis. Biosafety Level 2 and above must be done using a Class II or III Biosafety Cabinet. EHRS can help you determine which BSC is best suited for your use. Manufacturers of BSCs must meet or exceed a national certification standard promoted by the National Sanitation Foundation (NSF-49). In the field, the same standard dictates performance testing by a certified field service technician, usually a manufacturer-independent service contractor. The field certification testing includes:

- HEPA filter leak testing;
- Personnel, product, and cross contamination protection testing;
- Work access opening airflow (face velocity) testing; and
- Airflow smoke patterns testing.

The requirements for BSC use are:

- BSCs should be used for all techniques involving the use of specific biological agents or animal/human tissues and body fluids if there is a significant potential for the generation of infectious aerosols. Chemical use in BSCs should be minimized as some chemicals may degrade the performance of the HEPA filter;
- A chemical fume hood should not be used in the place of a BSC. Chemical fume hoods could cause sample contamination;
- All BSCs used as described in 1) above must be certified at least annually by a qualified technician. Please contact EHRS to arrange for this service. It is recommended that BSCs used for manipulation of non-hazardous biological materials be certified annually for programmatic reasons.
- **Note:** Clean (laminar flow) benches are not BSCs. Clean benches should be used for manipulation of sterile, non-hazardous samples only. They do not offer any personnel protection.

For further information on BSCs consult the Biosafety Manual.

Safety Shields and Other Containment Devices

Safety shielding is used for a chemical procedure when:

- Working with any substance that has a potential for violent reaction. This includes highly concentrated acids, bases, oxidizers or reducing agents;
- Working under non-ambient pressure (high vacuum or high pressure);

Other containment devices such as glove boxes and vented gas cabinets are used when:

- An inert atmosphere for the chemical procedure is needed;

- Highly efficient capture of any chemical emission is needed;
- A standard laboratory fume hood does not provide adequate assurance that overexposure to a hazardous chemical will not occur; or
- There are special containment requirements for certain biological or radioactive materials.

Ventilated chemical storage cabinets and rooms are used when stored chemicals may generate toxic, flammable or irritating levels of airborne contamination. These ventilated cabinets shall be ducted to the appropriate building chemical exhaust system. Chemical storage cabinets shall not be vented to the local laboratory environment.

Highly localized exhaust ventilation such as an overhead exhaust canopy may be required for equipment that exhausts toxic or irritating materials into the laboratory environment.

4.3 Air Sampling

Air sampling for evaluating employee exposure to chemical substances shall be conducted on request, as deemed necessary by EHRS, or as specified by particular regulations. When air sampling indicates exposure levels above the action level or Permissible Exposure Limit (PEL), control measures (e.g. chemical fume hood use) will be required.

4.4 Emergency Response

Telephone numbers of emergency personnel are posted throughout both OHSU campuses and in the Campus Contacts in the front section of this document. Each lab should also provide contact information for immediate access. It is recommended that contact names be posted on the outside of laboratory doors. All accidents and incidents should be reported to EHRS as soon as possible.

All students and employees are instructed in the proper usage of emergency showers and eyewashes during laboratory safety training. All laboratory areas are equipped with plumbed eyewashes and safety showers. The eyewash should be flushed monthly by laboratory employees to ensure that standing water is free of impurities. Facilities Services staff will flush safety showers at least annually. Spill kits with materials sufficient to handle incidental spills should be available to each lab. Each department is responsible for maintaining their own spill kits.

Further details regarding the appropriate response during a fire, explosion, chemical spill, or medical emergency are listed in Emergency Response Plan, available in the EHRS Office and on the OHSU intranet.

V. PLAN REVIEW

5.1 Annual Program Review

This Laboratory Safety document will be reviewed and evaluated for effectiveness by EHRS on an annual basis. Any changes will be made available to all departments who are in possession of the plan. An updated version will also be available on the EHRS website at http://ozone.ohsu.edu/ehrs/ .

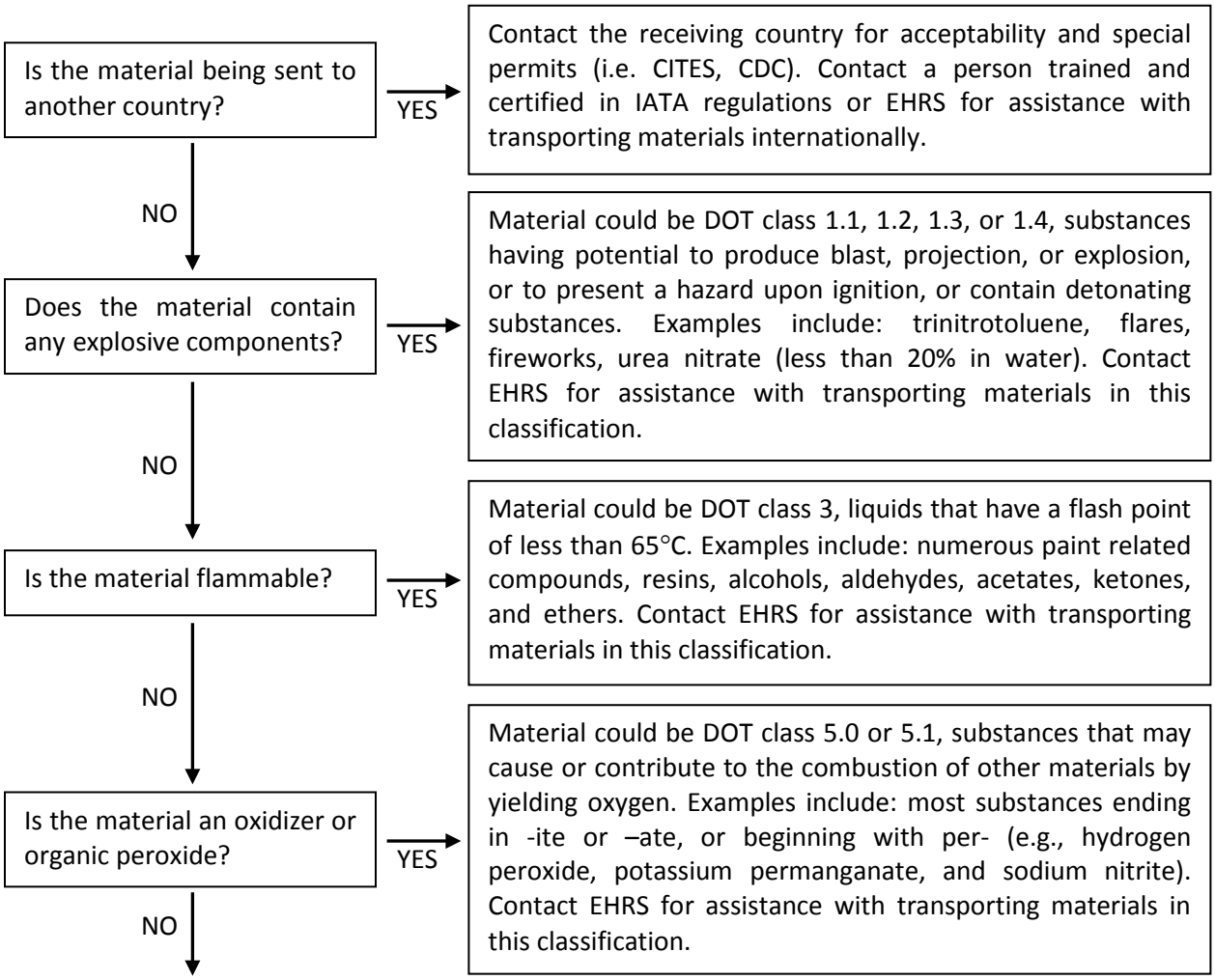
APPENDIX A

Hazardous Materials Transportation Guidelines

Numerous accidents occur involving the transportation of hazardous materials. These materials must be transported in accordance with local, state and federal regulations. The following guidelines should be followed in order to transport the material in a safe and legal manner.

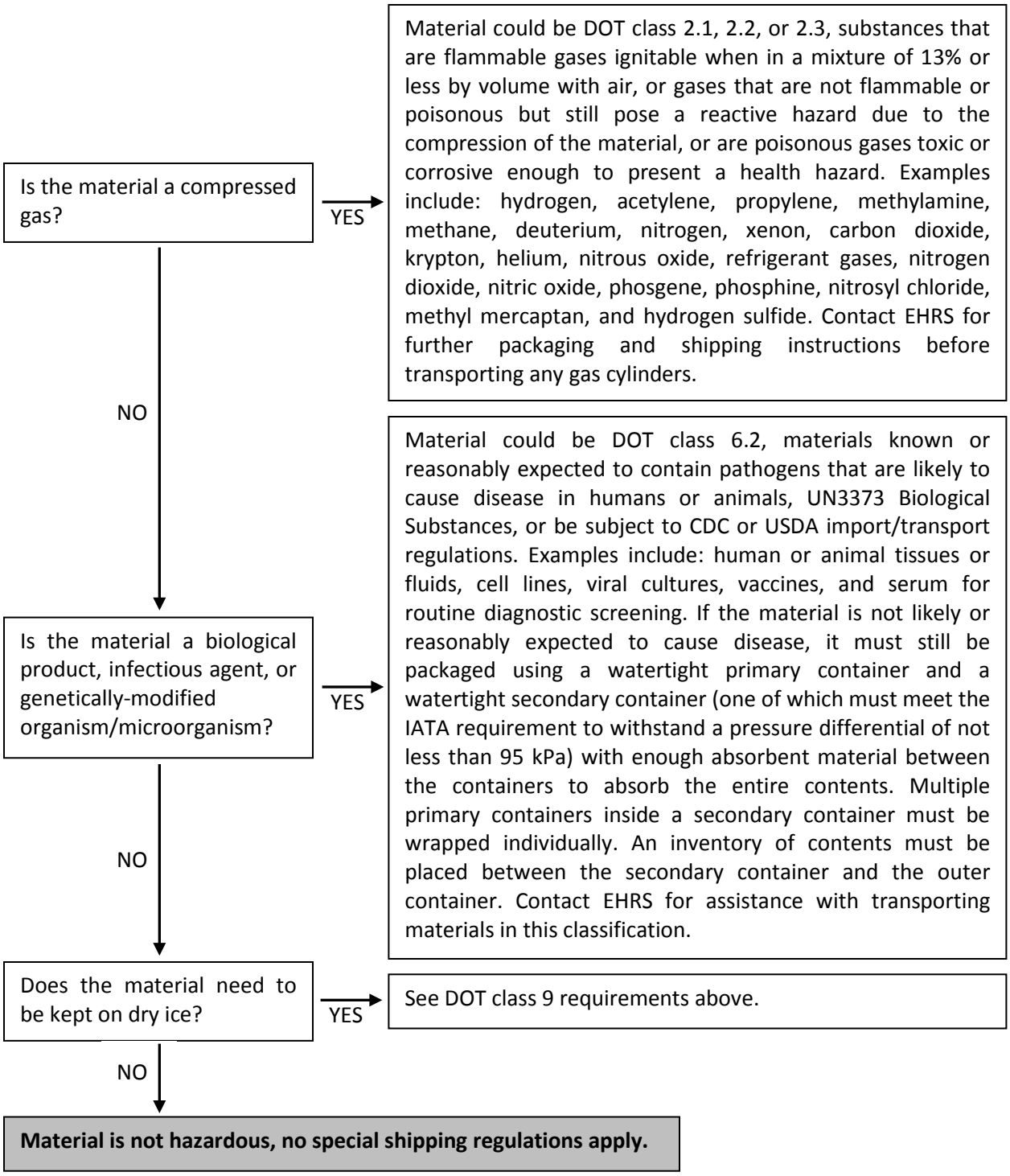
Known or suspected hazardous materials should be brought to designated trained employees for assistance with proper hazard determination, classification, packaging, labeling, marking, and documentation. Only designated, trained individuals are authorized to prepare dangerous goods for shipment. Some materials may not meet the definition of a dangerous good but may still require special packaging and shipping procedures. Examples of materials in this category include biological samples or diagnostic specimens that are not likely to cause disease in humans or animals.

HAZARDOUS MATERIALS TRANSPORTATION FLOW CHART



Go to next page

Go to next page


Is the material a compressed gas?
YES
Material could be DOT class 2.1, 2.2, or 2.3, substances that are flammable gases ignitable when in a mixture of 13% or less by volume with air, or gases that are not flammable or poisonous but still pose a reactive hazard due to the compression of the material, or are poisonous gases toxic or corrosive enough to present a health hazard. Examples include: hydrogen, acetylene, propylene, methylamine, methane, deuterium, nitrogen, xenon, carbon dioxide, krypton, helium, nitrous oxide, refrigerant gases, nitrogen dioxide, nitric oxide, phosgene, phosphine, nitrosyl chloride, methyl mercaptan, and hydrogen sulfide. Contact EHRS for further packaging and shipping instructions before transporting any gas cylinders.
NO
Is the material a biological product, infectious agent, or genetically-modified organism/microorganism?
YES
Material could be DOT class 6.2, materials known or reasonably expected to contain pathogens that are likely to cause disease in humans or animals, UN3373 Biological Substances, or be subject to CDC or USDA import/transport regulations. Examples include: human or animal tissues or fluids, cell lines, viral cultures, vaccines, and serum for routine diagnostic screening. If the material is not likely or reasonably expected to cause disease, it must still be packaged using a watertight primary container and a watertight secondary container (one of which must meet the IATA requirement to withstand a pressure differential of not less than 95 kPa) with enough absorbent material between the containers to absorb the entire contents. Multiple primary containers inside a secondary container must be wrapped individually. An inventory of contents must be placed between the secondary container and the outer container. Contact EHRS for assistance with transporting materials in this classification.
NO
Does the material need to be kept on dry ice?
YES
See DOT class 9 requirements above.
NO
Material is not hazardous, no special shipping regulations apply.

APPENDIX B

Storage of Compressed Gas Cylinders

Compressed gasses must be handled and stored in the following manner:

All areas containing compressed gasses must be labeled as such on the outer door.
All compressed gas cylinders must be stored in the upright position and secured against a sturdy object. The only exception is when cylinders are temporarily stored on cylinder transport hand trucks. In this case, the cylinders must be securely fastened to the cart.
Compressed gas cylinders must be moved using a cylinder transport hand truck, not rolled from one location to another.
Make sure the regulator is appropriate for the compound and fits snugly when in place.
Use a dilute soap solution to check for fish egg looking bubbles around the regulator and valve indicating a gas leak when the regulator is pressurized.

The following defines how compressed gas cylinders will be stored. Much of this policy, including the definitions of “toxic” and “highly toxic” materials, is taken from the 1994 Uniform Fire Code (UFC).

Minimum Requirements:

The following minimum safety requirements apply to all compressed gases or mixtures of gases that are classified by the Department of Transportation (DOT) as Poison Gas. These should arrive bearing a diamond shaped "poison" label. Examples of DOT poison gases include: fluorine, hydrogen sulfide, diborane and chlorine.

All DOT poison gases should be stored inside a ventilated enclosure such as a fume hood or ventilated storage cabinet.
All rooms containing DOT poison gases must have NFPA placards posted on the door, indicating the class of hazardous material stored inside.

When a cylinder of DOT poison gas is received, EHRS must be contacted to review worst case scenarios and to ensure applicable regulations are met.

UFC Definitions:

In keeping with the 1994 Uniform Fire Code, a toxic gas will be defined as:

Toxic gas - is a chemical whose median lethal concentration (LC_{50}) in air is more than 200 ppm but not more than 2,000 ppm (or between 2-20 mg/L) when administered by continuous inhalation for one hour or less to albino rats weighing between 200-300 grams each.

Highly toxic gas - is a chemical whose LC_{50} in air is 200 ppm or less (2 mg/L or less) when administered by continuous inhalation for one hour to albino rats weighing between 200-300 grams each. This includes, for example: arsine, diborane, fluorine, hydrogen cyanide, nitrogen dioxide, ozone, phosphine and stibene.

For gas mixtures - the LC_{50} shall be calculated as the weighted average of the LC_{50} of each individual gas in the mix, as follows:

LC_{50} mix = (10^6)/ [(ppm of gas #1/LC_{50} of gas #1) + (ppm of gas #2/LC_{50} of gas #2) +...]

Additional Requirements for UFC Toxic and Highly Toxic Gases:

The following additional precautions are required if more than 40 cubic feet of highly toxic gas or 3240 cubic feet of toxic gas are stored in any one fire control area on campus.

No more than three cylinders may be stored in any one cabinet.
Exhausted storage enclosures must be internally sprinklered and provide an average face velocity of not less than 200 ft/min, with a minimum of 150 ft/min at any one point.
Treatment systems must be installed to reduce the maximum allowable discharge concentration of gas to one-half the IDLH at the point of discharge to the atmosphere. (See UFC 8003 for more detail on treatment system design and performance).
A continuous gas-detection system must be installed to detect the presence of gas at or below OSHA's permissible exposure limit or ceiling limit. The detection system must initiate an alarm which is both audible and visible, and provide warning to people both inside and outside the storage area.
Emergency power must be provided for the exhaust ventilation system, the gas-detection system, the emergency alarm system, and any temperature control systems.

APPENDIX C

Glove Selection Charts

CHEMICAL COMPATIBILITY CHARTS FOR COMMON GLOVE MATERIALS

Unfortunately, there is no such thing as an all-purpose glove. All gloves will eventually degrade, however some materials may be more resistant to certain chemicals than others. When choosing protective clothing, one must select a material that is resistant to the chemical in question. In doing so, chemical penetration, permeation and degradation must be considered.

Penetration refers to the glove's ability to prevent leakage through holes, seams, and other voids.

Permeation is the term used to describe a chemical's ability to actually pass through the material used to make the glove. Permeation rates may be determined experimentally by applying a volume of concentrated chemical to one side of the glove and taking measurements on the opposite side to determine the time or rate of chemical permeation through the glove material. Permeation charts, such as the ones reproduced in this appendix, may be supplied by the manufacturer.

Degradation refers to the visible process of deterioration in the presence of a chemical. Some chemicals may actually dissolve, crack or otherwise damage a glove.

The following glove compatibility charts are provided by various manufacturers and research organizations The reader will note that they may not be entirely consistent, reflecting the different conclusions that may be reached depending on the type of test used to make the selection. One is sometimes forced to make the best decision possible, based on limited data. More information to help with glove selection is available from glove manufacturers and EHRS.

GLOVE TYPE SELECTION GUIDE

BuR	Butyl Rubber	S	Superior
Np	Neoprene	E	Excellent
PVC	Polyvinyl Chloride	G	Good
Nit	Nitrile	F	Fair
NL	Natural Latex	NR	Not Recommended
VP	Vinyl Plastic		
SL	Synthetic Latex		
PVA	Polyvinyl Alcohol		

CHEMICAL FAMILY	BuR	Np	PVC	Nit	NL	VP	SL	PVA
Acetates	G	NR	NR	NR	NR			
Acids, inorganic	G	E	E	E	E			
Acids, organic	E	E	E	E	E			
Acetonitrile, Acrylonitrile	G	E	G	S	E			
Alcohols	E	E	NR	E	E			
Aldehydes	E	G	NR	S*	NR			

Amines	S	NR	NR	F	NR			
Bases, inorganic	E	E	E	E	E			
Ethers	G	F	NR	E	NR			
Ethyl Acetate		G		G	F			
Ethyl Formate		E		E	F		G	G
Ethylene Dichloride		F		F	NR			
Ethylene Glycol		E	G	E	G			G
Fluorine		G	G	G				
Formaldehyde		E	E	E	G		E	
Formic Acid		E	E	F	G		E	
Freons		G	F	F	NR			E
Furfural		G		F	F			
Gasoline		G	F	E	NR	G	F	E
Glycerine		E	E	E	G		E	F
Grease		E		E	NR			
Halogens (Liquids)	G	NR	F	E	NR			
Hexane		G	F	G	NR			E
Hydraulic Fluid		G	F	G	F	E	E	E
Hydrofluoric Acid		E	G	E	G			
Hydrochloric Acid		E	G	E	G	E	G	
Hydrogen Peroxide		G	F	G	G		G	
Inks	G	E	E	S	F			
Iodine		G		G	G			
Isobutyl Alcohol		E	G	E	E	E	E	F
Isopropyl Alcohol	E	E	G	E	G	E	E	F
Kerosene		E				G		
Lacquer Thinner		G	F	G	F	G	G	E
Lactic Acid		E	G	G	G	E	E	
Linoleic Acid		E	G	E				E
Lubricating Oils		E	F	E	NR	G	F	E
Methyl Acetate		G		F	F			
CHEMICAL FAMILY	BuR	Np	PVC	Nit	NL	VP	SL	PVA
Methyl Alcohol		E	G	G	G	E	E	F
Methyl Cellosolve		E		G	NR	F	G	
Methyl Chloride		G		G	F		F	E
Methyl Ethyl Ketone		G		F	G	NR	G	F
Methyl Formate		G		F	F			
Methyl Isobutyl Ketone		G	F	G	G	NR	G	G
Mineral Oils		E		E	F			
Mineral Spirits		G	F	E	NR	G	F	E
Monoethanolamine		E		E	F			
Muriatic Acid		E	G	E	G	E	G	
Naptha		G	F	E	NR	G	F	E
Nitric Acid		F	F	G	NR	G	F	
Nitro Benzene		F		F	NR			E
Nitro Propane		F		F	NR			
Octyl Alcohol		E	F	E	F		E	G
Oleic Acid		E	F	E	F	E	F	E
Paint Thinner		G	F	G	F	G	F	E

Paint & Varnish Removers		G		G	NR	F	F	E
Pentane		E	F	E	NR			E
Perchlorethylene		F		G	NR	F	F	E
Perchloric Acid		E	F	G	G	E		
Phosphoric Acid		E	G	E	G		G	
Pine Oil		E	G	E	NR			E
Plating Solution		E	E	E	E		E	
Potassium Hydroxide		E	G	E	G	E	G	
Printing Inks		E	F	E	F	E	G	E
Propyl Acetate		G		G	F			
Rosin Oil		E		E	NR			
Sodium Hydroxide		E	G	E	G	E	G	
Sodium Hypochlorite		G		E	G			
Steric Acid		E	G	E	G		E	E
Stoddard Solvent		G	F	G	NR	F	F	E
Styrene		F		G	F	G	F	E
Sulfuric Acid		G	F	F	NR	G	F	
Tannic Acid		E	E	E	E	F	E	F
Toluene		F		G	NR	G	G	E
Trichlorethylene		F		G	NR	F	G	E
Tricresyl Phosphate		G		F	F			
Triethanolamine		E		E	F			
Trinitrotoluene		E		E	NR			
Tung Oil		E	F	E	NR	G	F	E
Turpentine		E		E	NR	E	G	
Vegetable Oils		G	F	E	F	E	G	E
Xylene		F		G	NR	F	G	E

* Not recommended for Acetaldehyde, use Butyl rubber.

Source: Yale University, Laboratory Chemical Hygiene Plan, 1991.

BREAKTHROUGH TIME RANKING

R	Rough Finish	U	Unsupported	NT	Not Tested
S	Smooth Finish	C	Coated	ND	None Detected at 8 Hours

					Natural Rubber		**PVC**		**Neoprene**		**Nitrile**	
CHEMICAL	BEST	2nd	3rd	4th	**Lower Detectable Limit**	Permeation Rate	Lower Detectable Limit	Permeation Rate	Lower Detectable Limit	Permeation Rate	Lower Detectable Limit	Permeation Rate
Acetaldehyde	NR/R	NR/S	Np	PVC	R - 23.0 S - 24.0	R - 5.0 S - 8.0	23.0	44.0	22.0	12.0	U - NT C - 21.0	U - NT C - 21.0
Acetone	NR/R	Np			R - 0.2 S - 0.2	R - 22.0 S - 48.0	NT	NT	0.2	259.0	U - NT C - NT	U - NT C - NT
Acetonitrile	Np	NR/R	PVC	NR/S	R - 18.0 S - 22.0	R - 6.0 S - 25.0	38.0	11.0	70.0	12.0	U - NT C - 58.0	U - NT C - 11.0

Chlorine Gas	Nit/C Np	PVC			R - NT S - NT	R - NT S - NT	40.0	1.0	40.0	ND	U - NT C - 40.0	U - NT C - ND
Dibutylphthalate	Np	Nit/C			R - NT S - NT	R - NT S - NT	NT	NT	250.0	ND	U - NT C - 250	U - NT C - ND
Diethyl amine	NR/R	Np	PVC	NR/S	R - 1.0 S - 1.0	R - 63.0 S - 89.0	1.0	69.0	1.0	66.0	U - NT C - 250	U - NT C - 97.0
Diethyl Ether	Nit/C	Np			R - NT S - NT	R - NT S - NT	NT	NT	0.4	55.0	U - NT C - 0.4	U - NT C - 44.0
Dimethyl Formamide	Np	Nit/C	Nit/U		R - NT S - NT	R - NT S - NT	NT	NT	38.0	9.0	U - 13.0 C - 73.0	U - 19.0 C - 11.0
Dioxane	PVC	Nit/C	Np		R - NT S - NT	R - NT S - NT	1.0	67.0	0.1	60.0	U - NT C - 3.0	U - NT C - 344
Ethylene Dibromide	Np	PVC	Nit/U	Nit/C	R - NT S - NT	R - NT S - NT	0.4	49.0	0.03	59.0	U - 0.3 C - 0.1	U - 68.0 C - 97.0
Ethylene Glycol Monoethyl Ether	Np	Nit/C	Nit/U	NR/R	R - 0.2 S - 25.0	R - 0.2 S - 0.1	3.0	1.0	2.0	1.0	U - 64.0 C - 5.0	U - 9.0 C - 7.0
Ethylene Oxide	Nit/U				R - NT S - NT	R - NT S - NT	NT	NT	NT	NT	U - 0.4 C - NT	U - 0.06 C - NT
Formaldehyde (37% in H_2O)	Nit/C PVC Nit/U				R - NT S - NT	R - NT S - NT	8.0	ND	41.0	ND	U - 0.4 C - 843	U - ND C - ND
N-Hexane	Np	Nit/U	PVC	Nit/C	R - NT S - NT	R - NT S - NT	0.2	15.0	0.3	2.0	U - 0.2 C - 1.0	U - 1.0 C - 141
Iso Octane	Np Nit/C Nit/U	PVC	NR/C		R - 0.03 S - 0.03	R - 10.0 S - 49.0	0.04	0.5	0.03	ND	U - 0.3 C - 0.4	U - ND C - ND
Methylene Chloride	PVC	Np	Nit/C		R - NT S - NT	R - NT S - NT	2.0	425.0	1.0	313.0	U - NT C - 1.0	U - NT C - 668
Methyl Ethyl Ketone	NR/R	NR/S			R - 1.0 S - 0.2	R - 87.0 S - 154	NT	NT	NT	NT	U - NT C - NT	U - NT C - NT
N-Methyl-2 Pyrrolidone	NR/R	Np	NR/S	PVC	R - 8.0 S - 8.0	R - ND S - 0.6	7.0	4.0	3.0	1.0	U - NT C - 26.0	U - NT C - 4.0
N-Pentanol	Nit/C	Np	PVC	NR/R	R - 0.1 S - 1.0	R - 86.0 S - 0.4	0.3	0.8	0.3	0.1	U - 3.0 C - 0.4	U - ND C - 0.2
Phenol (85% in H_2O)	Np	Nit/C	PVC		R - NT S - NT	R - NT S - NT	150.0	3.0	100.0	ND	U - NT C - 100	U - NT C - 3.0
Styrene (Monomer)	PVC	Np	Nit/C		R - NT S - NT	R - NT S - NT	0.4	26.0	3.0	5.0	U - NT C - 1.0	U - NT C - 76.0
Tetrahydrofuran	Nit/C	Np			R - NT S - NT	R - NT S - NT	NT	NT	1.0	138.0	U - NT C - 1.0	U - NT C - 155
Trichloroethylene	Np	PVC	Nit/U	Nit/C	R - NT S - NT	R - NT S - NT	1.0	150.0	0.9	137.0	U - .60 C - .30	U - 298 C - 216
Vinyl Chloride (Monomer)	Nit				R - NT S - NT	R - NT S - NT	NT	NT	NT	NT	U - NT C - .0005	U - NT C - .002
Xylene	PVC	Np	Nit/C		R - NT S - NT	R - NT S - NT	0.04	12.0	0.2	5.0	U - NT C - 0.3	U - NT C - 14.0

Ref: Sherwood Medical, Industrial Glove Wall Chart; ESB, Inc., Leader in Hand Safety; Edmont-Wilson, Job Fitted Glove Selector.

LATEX GLOVES

Latex gloves, particularly the type with powder added, can cause serious allergic reactions. Researchers should find substitutes for powdered latex gloves and avoid the use of even un-powdered latex whenever possible. Nitrile gloves may be substituted. Nitrile is non-allergenic and also provides a better barrier against most chemicals.

Latex products are manufactured from a milky, sap-like fluid derived from the rubber tree, *Hevea brasiliensis.* The more you are exposed, the greater the probability of becoming sensitized to natural latex proteins. There are three types of reactions that can occur in response to repeated latex exposure:

Irritant Contact Dermatitis is caused by skin irritation from using gloves and can also result from repeated hand washing and drying, or over-use of cleaners and sanitizers. Symptoms include dry, itchy, irritated skin. Not an allergic reaction.

Chemical Sensitivity Dermatitis is a delayed hypersensitivity (allergic) response resulting from exposure to the chemicals added to latex during harvesting, processing and manufacturing (not the latex itself). The rash is similar to that caused by poison ivy, is limited to the area in contact with the glove, and usually begins 6-48 hours after contact.

Latex Allergy is a reaction to the proteins in the latex itself. Symptoms usually occur within minutes of exposure. They range from mild (skin redness, hives, itching, sneezing, runny nose) to severe (difficulty breathing, coughing spells, wheezing, asthma and rarely, shock). People with a lot of exposure to latex and atopic individuals (those with asthma or other allergies, particularly to certain foods) are at increased risk.

About 10% of all health care workers are allergic to latex. Once sensitized, any latex can trigger a reaction in or out of the work place. Since more than 40,000 consumer, medical and household products are made of latex (syringes, rubber bands, tires, condoms, baby bottle nipples, etc.), and only a small amount of latex can cause an allergic response, victims of severe hypersensitivity may be forced to make drastic lifestyle changes.

Some brands of gloves contain significantly greater quantities of free latex protein and residual chemicals than others. The worst kinds of gloves are powdered. The proteins responsible for latex allergies bind to the cornstarch powder that is often added to latex gloves. The cornstarch allows the latex antigen to reach the wearer's skin more easily, particularly when the hand becomes wet with sweat or other fluids. Also, when powdered gloves are changed, latex protein/powder particles get into the air, where they can be inhaled and contact body membranes. Latex sensitization can occur from dermal or mucosal exposure as well as inhalation of small particles of latex protein. For this reason, sensitized people working in an area where powdered gloves are used can experience allergic symptoms even if they themselves are not wearing gloves.

Latex gloves offer the advantages of comfort, low cost, and providing a good barrier against blood-borne pathogens. However, they do not generally offer good protection against toxic chemicals and they may cause serious allergic reaction in sensitized individuals. The following are recommendations from the National Institute for Occupational Safety and Health (NIOSH) for preventing latex allergy in the workplace.

Whenever possible, wear non-latex gloves. When latex is necessary, chose reduced-protein, powder-free gloves. (Beware of gloves advertised as "hypoallergenic". These do not reduce the risk of latex allergy, but may reduce reactions due to chemical additives in the latex).

When wearing latex gloves, do not use oil-based hand creams or lotions since they can cause glove deterioration.

After removing latex gloves, wash hands with mild soap and dry thoroughly. Remove latex-containing dust from the workplace by frequently cleaning potentially contaminated areas (upholstery, carpets, ventilation ducts, filters, vacuum bags).

If you develop symptoms of latex allergy, avoid all contact with latex-containing products until you see an experienced physician.

APPENDIX D

Chart of Common Incompatible Chemicals

CHEMICAL	KEEP OUT OF CONTACT WITH
Acetic acid	Chromic acid, nitric acid hydroxyl compounds, ethylene glycol, perchloric acid, peroxides, permanganates
Acetone	Concentrated nitric and sulfuric acid mixtures
Acetylene	Chlorine, bromine, copper, fluorine, silver, mercury
Alkali metals	Water, carbon tetrachloride or other chlorinated hydrocarbons, carbon dioxide, halogens
Ammonia, anhydrous	Mercury, chlorine, calcium hypochlorite, iodine, bromine, hydrofluoric acid
Ammonium nitrate	Acids, metal powders, flammable liquids, chlorates, nitrates, sulfur, finely divided organic or combustible materials
Aniline	Nitric acid, hydrogen peroxide
Arsenical materials	Any reducing agent
Azides	Acids
Bromine	Same as chlorine
Calcium oxide	Water
Carbon (activated)	Calcium hypochlorite, all oxidizing agents
Carbon tetrachloride	Sodium
Chlorates	Ammonium salts, acids, metal powders, sulfur, finely divided organic or combustible materials
Chromic acid	Acetic acid, naphthalene, camphor, glycerin, turpentine, alcohol, flammable liquids
Chlorine	Ammonia, acetylene, butadiene, methane, propane (or other petroleum gases), hydrogen, sodium carbide, turpentine, benzene, finely divided metals
Chlorine dioxide	Ammonia, methane, phosphine, hydrogen sulfide
Copper	Acetylene, hydrogen peroxide
Cumene hydroperoxide	Acids, organic and inorganic
Cyanides	Acids
Flammable liquids	Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, halogens
Hydrocarbons	Fluorine, chlorine, bromine, chromic acid, sodium peroxide
Hydrocyanic acid	Nitric acid, alkali
Hydrofluoric acid	Ammonia, aqueous or anhydrous
Hydrogen peroxide	Copper, chromium, iron, most metals or their salts, alcohols, acetone, organic materials, aniline, nitromethane, flammable liquids, oxidizing gases
Hydrogen sulfide	Fuming nitric acid, oxidizing gases, acetylene, ammonia (aqueous or anhydrous), hydrogen
Hypochlorites	Acids, activated carbon
Iodine	Acetylene, ammonia (aqueous or anhydrous), hydrogen
Mercury	Acetylene, fulminic acid, ammonia

Nitrates	Sulfuric acid
Nitric acid (conc.)	Acetic acid, aniline, chromic acid, hydrocyanic acid, hydrogen sulfide, flammable liquids, flammable gases
Nitrites	Acids
Nitroparaffins	Inorganic bases, amines
Oxalic acid	Silver, mercury
Oxygen	Oils, grease, hydrogen; flammable liquids, solids, or gases
Perchloric acid	Acetic anhydride, bismuth and its alloys, alcohol, paper, wood
Peroxides, organic	Acids (organic or mineral), avoid friction, store cold
Phosphorus (white)	Air, oxygen, alkalis, reducing agents
Potassium	Carbon tetrachloride, carbon dioxide, water
Potassium permanganate	Glycerin, ethylene glycol, benzaldehyde, sulfuric acid
Selenides	Reducing agents
Silver	Acetylene, oxalic acid, tartaric acid, ammonium compounds
Sodium	Carbon tetrachloride, carbon dioxide, water
Sodium nitrite	Ammonium nitrate and other ammonium salts
Sodium peroxide	Ethyl or methyl alcohol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerin, ethylene glycol, ethyl acetate, methyl acetate, furfural
Sulfides	Acids
Sulfuric acid	Potassium chlorate, potassium perchlorate, potassium permanganate (or compounds with similar light metals, such as sodium, lithium, etc.)
Tellurides	Reducing agents

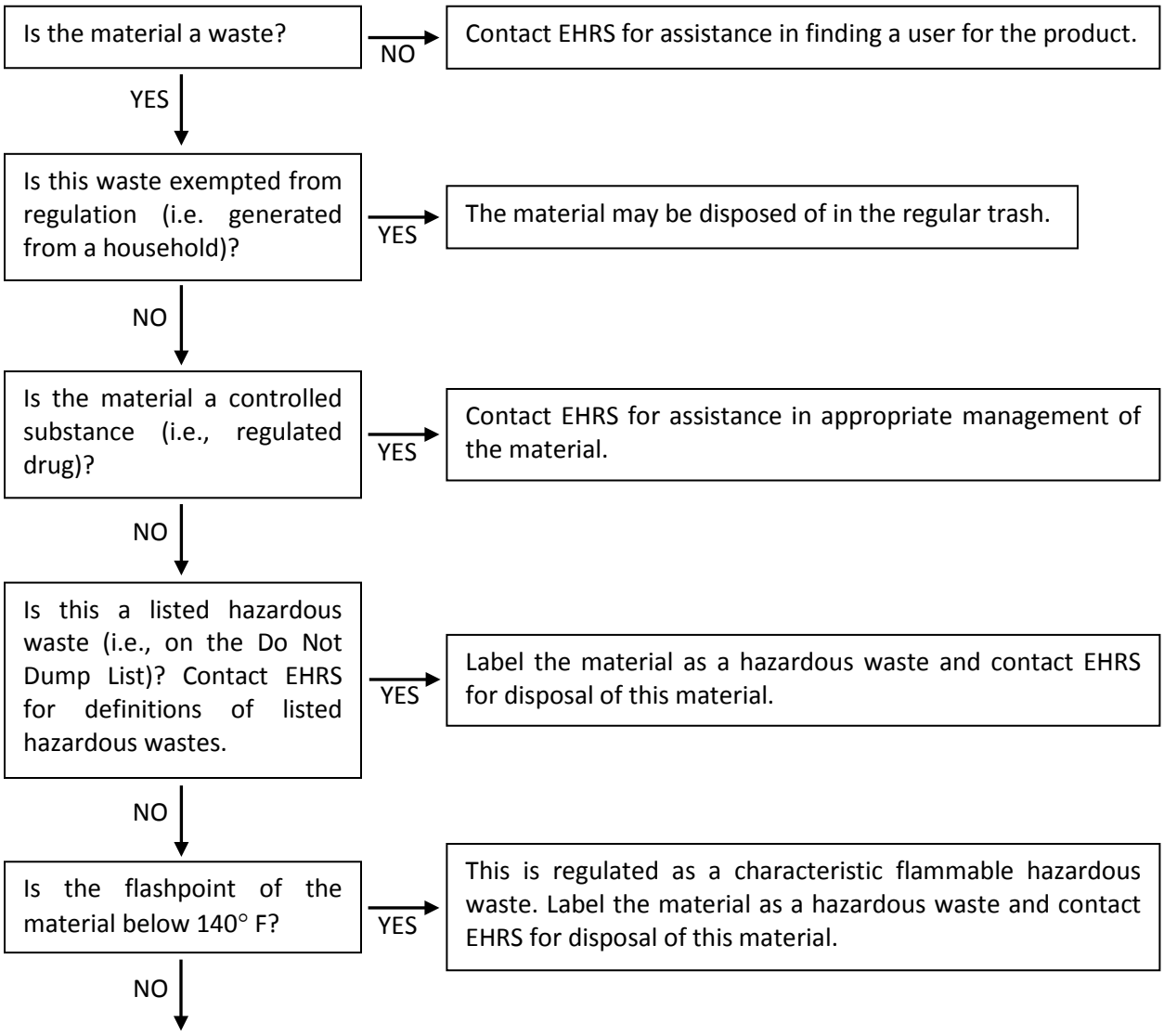
Ref: Manufacturing Chemists' Association, Guide for Safety in the Chemical Laboratory

APPENDIX E

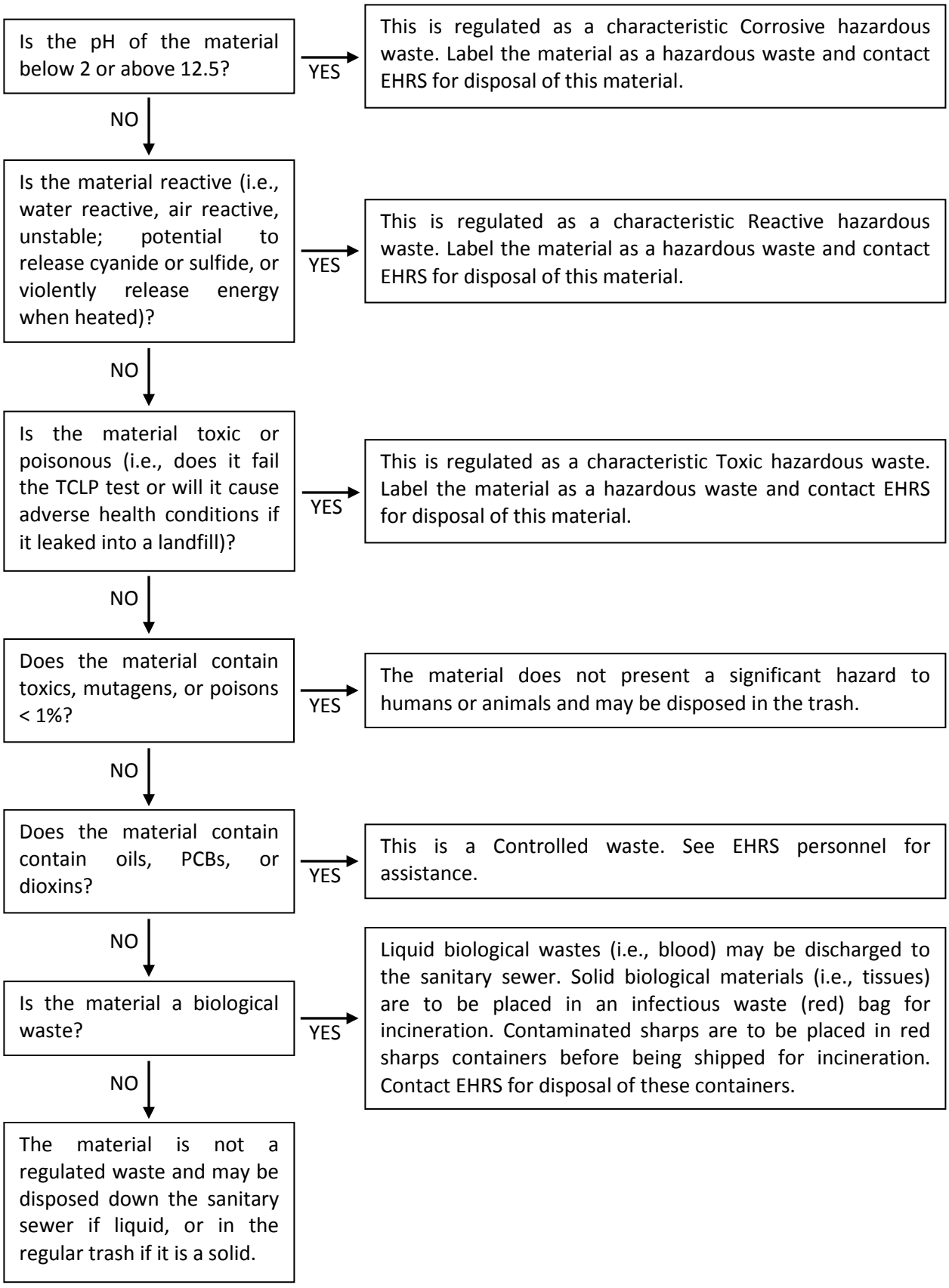
Disposal of Hazardous Materials

Some chemicals are regulated as to methods of disposal. These include any chemicals listed on the "Do Not Dump" List at the end of this Appendix and other chemicals that are flammable, corrosive, reactive or toxic. EHRS should be consulted if there is any question whether or not a material requires special disposal. EHRS collects hazardous waste and arranges for disposal at licensed treatment storage and disposal facilities.

The following flow chart can be used as a guide to assist with disposal options.



Go to next page


Is the pH of the material below 2 or above 12.5?
YES
This is regulated as a characteristic Corrosive hazardous waste. Label the material as a hazardous waste and contact EHRS for disposal of this material.
NO
Is the material reactive (i.e., water reactive, air reactive, unstable; potential to release cyanide or sulfide, or violently release energy when heated)?
YES
This is regulated as a characteristic Reactive hazardous waste. Label the material as a hazardous waste and contact EHRS for disposal of this material.
NO
Is the material toxic or poisonous (i.e., does it fail the TCLP test or will it cause adverse health conditions if it leaked into a landfill)?
YES
This is regulated as a characteristic Toxic hazardous waste. Label the material as a hazardous waste and contact EHRS for disposal of this material.
NO
Does the material contain toxics, mutagens, or poisons < 1%?
YES
The material does not present a significant hazard to humans or animals and may be disposed in the trash.
NO
Does the material contain contain oils, PCBs, or dioxins?
YES
This is a Controlled waste. See EHRS personnel for assistance.
NO
Is the material a biological waste?
YES
Liquid biological wastes (i.e., blood) may be discharged to the sanitary sewer. Solid biological materials (i.e., tissues) are to be placed in an infectious waste (red) bag for incineration. Contaminated sharps are to be placed in red sharps containers before being shipped for incineration. Contact EHRS for disposal of these containers.
NO
The material is not a regulated waste and may be disposed down the sanitary sewer if liquid, or in the regular trash if it is a solid.

CHEMICAL WASTE DISPOSAL

The following chemicals should **NEVER** be disposed of via any type of drain regardless of concentration (unless specified). Chemical destruction/neutralization of solutions containing these chemicals must follow established procedures, and each procedure must be confirmed by EHRS (Ext. 4-7795). This list of chemicals is subject to frequent updating. Chemicals **NOT** on this list may be disposed of via sewer drains only at concentrations below 10% in aqueous solution. The only exception to this 10% rule is Ethyl Alcohol. Ethanol may be drain disposed at any concentration. In addition, all aqueous solutions for disposal must be in the pH range of 5.0 - 11.5. For disposal of chemicals on this list, contact EHRS.

Abrin
Acetaldehyde, chloro-
Acetaldehyde, trichloro
Acetamide, N-(aminothioxomethyl)-
Acetamide, N-9H-fluoren-2-yl
Acetamide, 2-fluoro-
Acetic acid, (2,4-dichlorophenoxy)-, salts & esters
Acetic acid, fluoro-, sodium salt
Acetic acid, (2,4,5-trichlorophenoxy)-
Acetic acid, trifluoro-
1-Acetyl-2-thiourea
Acrolein
Acrylamide
Acrylic acid
Aflatoxins
Aldicarb
Aldicarb sulfone
Aldrin
Allyl alcohol
Aluminum phosphide
5-(Aminomethyl)-3-isoxazolol
4-Aminopyridine
Ammonium picrate
Ammonium vanadate
Argentate (1-),bis(cyano-C)-,potassium
Arsenic containing compounds
Arsine, diethyl-
Arsonous dichloride, phenyl-
Aziridine
Aziridine,2-methyl-
Barban
Barium containing compounds
Benzal chloride
Benzamide,3,5-dichloro-N-(1,1-dimethyl-2-propynyl)-
Benzenamine,4-chloro-
Benzenamine,4-chloro-2-methyl-,hydrochloride
Benzenamine,4,4'-methylenebis[2-chloro-
Benzenamine, 4-nitro-
Benzene
Benzene acetic acid, 4-chloro-alpha-(4-chlorophenyl)-alpha-hydroxy-,ethyl ester
Benzene, 1-bromo-4-phenoxy-
Benzenebutanoic acid, 4-[bis(2-chloroethyl)amino]-

Benzene, chloro-
Benzene, (chloromethyl)-
Benzene,1,2-dichloro-
Benzene,1,3-dichloro-
Benzene,1,4-dichloro-
Benzene,1,1'(2,2-dichloroethylidene)bis[4-chloro-
Benzene, (dichloromethyl)-
1,2-Benzenediol,4-[1-hydroxy-2-(methylamino)ethyl]-,
Benzeneethanamine,alpha, alpha-dimethyl-
Benzene, hexachloro-
Benzene, pentachloro-
Benzene, pentachloronitro-
Benzene, 1,2,4,5-tetrachloro-
Benzenethiol
Benzene,1,1'-(2,2,2-trichloroethylidene)bis[4-chloro-
Benzene,1,1'-(2,2,2-trichloroethylidene)bis[4-methoxy-
Benzene, (trichloromethyl)-
2H-1-Benzopyran-2-one,4-hydroxy-3-(3-oxo-1-phenylbutyl)-, & salts
Benzo(a)pyrene
Benzotrichloride
Benzoyl peroxide
Benzyl chloride
Beryllium Powder
[1,1'-Biphenyl]-4,4'-diamine,3,3'-dichloro-
Bis(2-chloroethoxy)methane
Bis(2-chloroisopropyl)ether
BMAA (L)
BMAA HCl
Botulinum toxins
Bromoacetone
Bromoform
Bromomethan
4-Bromophenyl phenyl ether
Brucine
1,3-Butadiene,1,1,2,3,4,4-hexachloro-
2-Butanone,3,3-dimethyl-1-(methylthio)-,O-[methylamino)carbonyl]oxime
2-Butene,1,4-dichloro-
Butyl lithium
Cacodylic acid
Cadmium containing compounds
Calcium cyanide
Carbamic chloride, dimethyl-
Carbofuran
Carbon disulfide
Carbon oxyfluoride
Carbon tetrachloride
Carbonic dichloride
Carbonic difluoride
Carbonochloridic acid, methyl ester,
Carbosulfan
Chloral
Chlorambucil
Chlordane

Chlornaphazin
Chloroacetaldehyde
p-Chloroaniline
Chlorobenzene
Chlorobenzilate
2-Chloroethyl vinyl ether
Chloroform
Chlorokynurenic acid
p-Chloro-m-cresol
Chloromethyl methyl ether
□-Chloronaphthalene
Chloro-o-toluidine, hydrochloride
o-Chlorophenol
1-(o-Chlorophenyl)thiourea
3-Chloropropionitrile
Chromium containing compounds
Clostridium perfringens epsilon toxin
Conotoxins
Copper cyanide
m-Cumenyl methylcarbamate
Cyanides (soluble cyanide salts)
Cyanogen
Cyanogen bromide
Cyanogen chloride
Cyclohexane
Cyclohexane,1,2,3,4,5,6-hexachloro-
2-Cyclohexyl-4,6-dinitrophenol
1,3-Cyclopentadiene,1,2,3,4,5,5-hexachloro-
2,4-D, salts & esters
DDD
DDE
DDT
Diacetoxyscirpenol
Diaminobenzidine
Dibromochloroethane (DBCM)
1,2-Dibromo-3-chloropropane
Dibromomethane
m-Dichlorobenzene
o-Dichlorobenzene
p-Dichlorobenzene
3,3'-Dichlorobenzidine
1,4-Dichloro-2-butene
Dichlorodifluoromethane
1,2-Dichloroethane
1,1-Dichloroethylene
1,2-Dichloroethylene
Dichloroethyl ether
Dichloroisopropyl ether
Dichloromethoxy ethane
Dichloromethyl ether
2,4-Dichlorophenol
2,6-Dichlorophenol
Dichlorophenylarsine

1,3-Dichloropropene
Dieldrin
Diethylamine
Diethylarsine
Diethyl-p-nitrophenyl phosphate
O,O-Diethyl O-pyrazinyl phosphorothioate
Diisopropylfluorophosphate (DFP)
1,4,5,8-Dimethanonaphthalene,1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a,-hexahydro-
2,7:3,6-Dimethanonaphth[2,3-b]oxirene,3,4,5,6,9,9-hexachloro-1a,2,2a,3,6,6a,7,7a-octahydro-
2,7:3,6-Dimethanonaphth[2,3-b]oxirene,3,4,5,6,9,9-hexachloro-1a,2,2a,3,6,6a,7,7a-octahydro-
1,4,5,8-Dimethanonaphthalene,1,2,3,4,10,10-hexa-chloro-1,4,4a,5,88a,-hexahydro-
Dimethoate
Dimethylaminoazobenzene (DAB)
Dimethylcarbamoyl chloride
□,□-Dimethyl-phenethylamine
Dimetilan
4,6-Dinitro-o-cresol, & salts
2,4-Dinitrophenol
Dinoseb
1,4 Dioxane
Dioxins (all)
Diphosphoramide,octamethyl-
Diphosphoric acid, tetraethyl ester
Disulfoton
Dithiobiuret
Domoic acid
Dursban
Endosulfan
Endothall
Endrin
Epichlorohydrin
Ethane, 1,2-dibromo
Ethane,1,1-dichloro-
Ethane, 1,2-dichloro-
Ethanedinitrile
Ethane, hexachloro-
Ethane, 1,1'-[methylenebis(oxy)]bis[2-chloro-
Ethane,1,1'-oxybis[2-chloro-
Ethane, pentachloro-
Ethane,1,1,1,2-tetrachloro-
Ethane,1,1,2,2-tetrachloro-
Ethane, 1,1,2-trichloro
Ethane,1,1,1-trichloro-
Ethanimidothioic acid,N-[[(methylamino)carbonyl]oxy]-, methyl ester
Ethene, chloro-
Ethene, (2-chloroethoxy)-
Ethene,1,1-dichloro-
Ethene,1,2-dichloro-,(E)-
Ethene, tetrachloro-
Ethene, trichloro-
Ethidium bromide
Ethyl cyanide
Ethylene dibromide

Ethyleneimine
Ethyl ether
Ethylidene dichloride
Famphur
Fluorine
Fluoroacetamide
Fluoroacetic acid, sodium salt
Formetanate hydrochloride
Formparanate
Furans (Halogenated)
Heptachlor (and its epoxide)
Heptane
Hexachlorobenzene
Hexachlorobutadiene
Hexachlorocyclopentadiene
Hexachloroethane
Hexachlorophene
Hexachloropropene
Hexaethyl tetraphosphate
Hexane
Hexanedione
Hydrazine
Hydrazinecarbothioamide
Hydrazine, methyl-
Hydrobromic acid
Hydrocyanic acid
Hydrofluoric acid
Hydrogen bromide
Hydrogen cyanide
Hydrogen fluoride
Hydrogen phosphide
Isodrin
Isohexane
Isolan
Isopentane
Isopropyl B-D-Thiogalactopyranoside
3(2H)-Isoxazolone, 5-(aminomethyl)-
Kepone
Lead containing compounds
Lindane
Manganese dimethyldithiocarbamate
Melphalan
Mercury containing compounds
Methanamine,N-methyl-N-nitroso-
Methane, bromo-
Methane, chloro-
Methane, chloromethoxy-
Methane, dibromo-
Methane, dichloro-
Methane, dichlorodifluoro-
Methane, iodo-
Methane, isocyanato-
Methane,oxybis[chloro-

Methane, tetrachloro-
Methane, tetranitro-
Methanethiol, trichloro-
Methane, tribromo-
Methane, trichloro-
Methane, trichlorofluoro-
6,9-Methano-2,4,3-benzodioxathiepin,6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-,3-oxide
4,7-Methano-1H-indene,1,2,4,5,6,7,8,8-octachloro-2,3,3a,4,7,7a-hexahydro-
1,3,4-Metheno-2H-cyclobuta[cd]pentalen-2-one,1,1a,3,3a,4,5,5,5a,5b,6-decachlorooctahydro-
Methiocarb
Methomyl
Methoxychlor
3-Methylamine HCl
Methylazoxymethyl acetate
Methyl bromide
2-Methyl butane
Methyl chloride
Methyl chloroform
4,4'-Methylenebis(2-chloroaniline)
Methylene bromide
Methylene chloride
Methyl hydrazine
Methyl iodide
Methyl isocyanate
2-Methyllactonitrile
Methyl mercuric chloride
Methyl methacrylate
Methyl parathion
2-Methyl pentane
1-Methyltin trichloride
Metolcarb
Mexacarbate
Mirex
Molybdenum containing compounds
N-Nitrosodimethylamine
N-Nitrosomethylvinylamine
Naphthalenamine,N,N’-bis (2-chlroethyl)-
Naphthalene,2-chloro-
□-Naphthylthiourea
Nickel cyanide
Nickel carbonyl
Nitric oxide
p-Nitroaniline
Nitrogen dioxide
Nitrogen oxide NO
Nitroglycerine
N-Nitrosodimethylamine
N-Nitrosomethylvinylamine
Octachlorostyrene
Octamethylpyrophosphoramide
Octane
Osmic acid
Osmium tetroxide

7-Oxabicyclo[2.2.1]heptane-2,3-dicarboxylic acid
Oxamyl
2H-1,3,2-Oxazaphosphorin-2-amine,N,N-bis(2-chloroethyl)tetrahydro-,2-oxide
Oxirane, (chloromethyl)-
Parathion
Pentachlorobenzene
Pentachloroethane
Pentachloronitrobenzene (PCNB)
Pentachlorophenol
Pentane
Perchlorethylene
Perchloric acid
Petroleum Ether
Phenol, 2-chloro-
Phenol,4-chloro-3-methyl-
Phenol,2-cyclohexyl-4,6-dinitro-
Phenol,2,4-dichloro-
Phenol,2,6-dichloro-
Phenol,2,4-dinitro-
Phenol,2,2'-methylenebis[3,4,6-trichloro-
Phenol,2-(1-methylpropyl)-4,6-dinitro-
Phenol,2,3,4,6-tetrachloro-
Phenol,2,4,5-trichloro-
Phenol,2,4,6-trichloro-
Phenol,2,4,6-trinitro-, ammonium salt
L-Phenylalanine,4-[bis(2-chloroethyl)amino]-
Phenylhydrazine
Phenylmethyl sulfonylfluoride
Phenylthiourea
Phorate
Phosgene
Phosphine
Phosphoric acid, diethyl 4-nitrophenyl ester
Phosphorodithioic acid,O,O-diethyl S[(ethylthio)methyl] ester
Phosphorodithioic acid,O,O-diethyl S-[2-(ethylthio)ethyl]ester
Phosphorodithioic acid, O,O-dimethyl S-[2-(methylamino)-2-oxoethyl] ester
Phosphorofluoridic acid,bis(1-methylethyl)ester
Phosphorothioic acid,O,O-diethyl-O-(4-nitrophenyl) ester
Phosphorothioic acid,O,O-diethyl 0-pyrazinyl ester
Phosphorothioic acid O-[4-[(dimethyl amino)sulfonyl]phenyl]O,O-dimethyl ester
Phosphorothioic acid,O,O,-dimethyl O-(4 nitrophenyl) ester
Phosphorus pentoxide
Physostigmine
Physostigmine salicylate
Plumbane, tetraethyl-
Podophyllotoxin
Polychloronated biphenyls (all)
Potassium cyanide
Promecarb
Pronamide
Propanal,2-methyl-2-(methylthio)-,O-[(methylamino)carbonyl]oxime
Propane,1,2-dibromo-3-chloro-
Propane, 1,2-dichloro-

Propanenitrile
Propanenitrile,3-chloro-
Propanenitrile,2-hydroxy-2-methyl-
Propane,2,2'-oxybis[2-chloro-
1,2,3-Propanetriol,trinitrate
Propanoic acid,2-(2,4,5-trichlorophenoxy)-
2-Propanone,1-bromo-
Propargyl alcohol
2-Propenal
1-Propene,1,3-dichloro-
1-Propene, 1,1,2,3,3,3-hexachloro-
2-Propen-1-ol
Propylene dichloride
2-Propyn-1-ol
1,2-Propylenimine
4-Pyridinamine
Pyridine,3-(1-methyl-2-pyrrolidinyl)-,(S)-,salts
2,4-(1H,3H)-Pyrimidinedione,5-[bis(2-chloroethyl)amino]-
Ricin
Saxitoxin
Selenium containing compounds
Shigatoxin
Silver containing compounds
Silvex(2,4,5-TP)
2,4,5 TP Silvex
Sodium azide (>0.3%)
Sodium cacodylate
Sodium cyanide
Sodium metal
Sodium methoxide
Staphylococcal enterotoxins
Strychnidin-10-one, & salts
Strychnidin-10-one,2,3-dimethoxy-
Strychnine, & salts
Strychnine HCl
Sulfuric acid, dithallium^{+} salt
2,4,5-T
1,2,4,5-Tetrachlorobenzene
1,1,1,2-Tetrachloroethane
1,1,2,2-Tetrachloroethane
Tetrachloroethylene
2,3,4,6-Tetrachlorophenol
Tetraethyldithiopyrophosphate
Tetraethyl lead
Tetraethyl pyrophosphate
Tetrahydrofuran
Tetranitromethane
Tetraphosphoric acid, hexaethyl ester
Tetrodotoxin
Thallic oxide
Thallium oxide Tl_2O_3
Thallium (I) selenite
Thallium (I) sulfate

Thiodiphsophoric acid, tetraethyl ester
Thiofanox
Thioimidodicarbonic diamide[$(H_2N)C(S)]_2NH$
Thiophenol
Thiosemicarbazide
Thiourea,(2-chlorophenyl)-
Thiourea, 1-naphthalenyl-
Thiourea, phenyl-
Tirpate
Toluene
Totenone
T-2 toxin
Toxaphene
Trichloroacetic acid
1,1,2-Trichloroethane
Trichloroethylene
Trichloromethanethiol
Trichloromonofluoromethane
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol
Triethanolamine
5-Triethyltin bromide
Trifluoroacetic acid
Trimethyl pentane
Trimethyltin bromide
Trimethyltin chloride
Uracil mustard
Uranyl acetate
Vanadic acid, ammonium salt
Vanadium oxide V_2O_5
Vinblastine
Vincristine sulfate
Vinylamine,N-methyl-N-nitroso-
Vinyl chloride
Warfarin, & salts
Xylene
Zinc cyanide
Zira

APPENDIX F

Disposal of Biological Waste

Central & Waterfront Campus. Biological waste disposal guidelines are provided in the following document, which is available on request from the Biosafety Officer.

GENERAL WASTE	REGULATED MEDICAL WASTE			OTHER HAZARDOUS WASTE
	Red Biohazard Bags	Rigid Sharps Containers	Pathological Waste	
ALL disposable items not contaminated with infectious or otherwise hazardous waste, including: • ALL items containing blood or body fluids that cannot be expelled when squeezed or forcibly compressed • Gloves, gowns, shoe covers • Paper towels • Bench paper • All Q-Tips, swabs • Plasticware ✓ petri dishes ✓ serological pipettes ✓ micropipette tips ✓ microcentrifuge tubes ✓ plastic test tubes	ANY containers of liquid blood or any body fluid ANY items containing blood or body fluids that could be expelled when squeezed or forcibly compressed ALL cultures of infectious agents, including culture dishes and swabs or other devices used for transfer; inoculates and mix cultures ANY potentially infectious materials not covered above ALL Biohazard Bags/Labels, **new or used** DO NOT INCLUDE: ✓ garbage ✓ hazardous waste ✓ sharps ✓ sharps containers	ALL sharps, **used or unused**, including: • Needles • ALL syringes • Razor blades • Scalpel blades • Glass tubes • Glass slides • Glass pipettes	ALL human tissue (bone, fat, placentas, body parts, etc.) **Note**: Special handling and record keeping is required. Place waste in separate red bags with patient's name. ALL animal carcasses and tissues	**Broken Glass** Place in special broken glass containers. Seal filled containers and alert housekeeping staff for removal. **Radioactive Waste** Segregate from other waste and shield as necessary. Call EHRS (4-2578) for removal. **Hazardous Chemical Waste** Collect hazardous waste in appropriate sealed container(s). Call EHRS (4-2585) for removal.
Disposal Instructions	**Disposal Instructions**	**Disposal Instructions**	**Disposal Instructions**	
Regular scheduled removal by housekeeping staff.	Seal top of bag with rubber bands. All contents must be fully enclosed and any holes must be sealed. Regular scheduled removal by housekeeping staff. Autoclaving is not necessary.	Seal filled containers and alert housekeeping staff for removal. Note: sharps containers should NOT be placed in red biohazard bags.	Place in red biohazard bags. Call Kathy Croft (4-8813) for removal.	

West Campus. Solid biohazard waste is to be collected in a red biohazard bag lined with clear autoclave bag that does not contain a biohazard symbol. When full, the inner liner should be closed with autoclavable rubber bands or autoclave tape and transported immediately to the autoclave. After autoclaving the sterilized waste can be disposed in the regular trash. *No red biohazard bags, or items containing the biohazard symbol are to be placed in regular trash.* Biohazard liquids are to be autoclaved before drain disposal. Sharps are to be disposed of in rigid sharps containers only. When full, the sharps container should be closed and placed in the Biohazard disposal area adjacent to Research Stores in accordance with EHRS guidelines. Regulated biomedical waste (i.e., animal carcasses) is to be placed in collection areas for disposal by EHRS, following EHRS guidelines. For additional information contact the West Campus EHRS office.