University of New Haven

POLICIES AND PROCEDURES

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Policy Title:

Chemical Hygiene Plan

Responsible Office: Department of Public Safety

Responsible Official: Associate VP of Public Safety & Administrative Services

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1.0 University of New Haven's Commitment to Safety

The University of New Haven provides a safe and healthy work environment in accordance with the Occupational Safety and Health Act (OSHA) 29 CFR 1910.1450 "Occupational Exposure to Hazardous Chemicals in Laboratories" also known as the Laboratory Standard. Commitment to health and safety is the responsibility of individuals at all levels to protect the safety and health of all employees, students and the environment.

1.1 Purpose

The purpose of the Chemical Hygiene Plan (CHP) is to provide guidance to University laboratory personnel for working safely in the laboratory environment. The CHP complies with the requirements of OSHA's Laboratory Standard and describes proper laboratory practices, procedures, protective equipment and hazard identification. The CHP is available within the Associate Vice President of Public Safety & Administrative Service's office and within the main office of the Chemistry, Biology, Forensics and Dental departments. A copy of the CHP shall be readily available to all personnel in the laboratory via MyCharger.

1.2 Scope

The provisions of the CHP apply to all University laboratory personnel, other employees who routinely visit or occasionally work in the laboratory and all contractors who might be exposed to laboratory hazards while at the University. All laboratory personnel are encouraged to contribute their skills and knowledge to the CHP such as routine activities, chemical safety, hazardous material handling or procedures to minimize chemical exposure.

The Associate Vice President of Public Safety & Administrative Services will annually review the Chemical Hygiene Plan for effectiveness and amend as necessary. Advice will be sought from the Chemistry, Biology, Forensics and Dental departments as to the effectiveness of the plan at least annually. All new laboratory personnel will be required to review and understand the CHP as part of their New Employee Orientation and all laboratory personnel will receive annual CHP training.

2.0 Roles and Responsibilities

2.1 Department Chairs of the Science Disciplines

- Responsible for the implementation of the CHP within laboratories under their control;
- Assure laboratory staff complete, at least annually, a laboratory specific training on the CHP and its contents;
    - Laboratory staffs are identified as lab managers, professors, adjunct faculty and teaching assistants.
- Employees can include students, volunteers, minors and researchers;
- Implement safe laboratory practices and engineering controls to minimize the potential exposure to hazardous chemicals;
- Ensure that equipment and protective devices are available and in working order, and that appropriate training has been provided;
- Responsible for performing operations within the provisions of the CHP and other safety and health related procedures;
- Practice good chemical hygiene;
- Complete necessary trainings;
- Review and understand the CHP and applicable laboratory specific procedures in their entirety before beginning work in the laboratory or with hazardous chemicals; and
- In cooperation with the Associate Vice President of Public Safety & Administrative Services, review the CHP for effectiveness and amend as necessary at least annually.

2.2 Associate Vice President of Public Safety & Administrative Services

- Responsible for scheduling CHP training with the Department Chair, faculty, contractors and Facilities Department staff;
- Responsible for assuring safe practices are implemented and practiced within the laboratory setting; and
- Review the CHP for effectiveness in cooperation with the Chemistry, Biology, Forensics and Dental department chairs and amend as necessary at least annually.

2.3 Chemical Hygiene Officer (CHO)

- With intimate knowledge of laboratory practices, the acting CHO's have been identified as the laboratory managers within the Biology, Chemistry, Forensics, Fire Science, Engineering and Dental Hygiene departments;
- The CHO along with the assistance from the department chair and the Associate Vice President of Public Safety & Administrative Services shall work with staff within their respective departments to ensure compliance with the CHP;
- Assist in providing guidance in the development and the implementation of the CHP within their specific laboratory area/department;
- Review the CHP with appropriate committees as necessary and at least annually with the Associate Vice President of Public Safety & Administrative Services;
- Assist laboratory personnel in the development of laboratory-specific safety procedures and selection of engineering controls and personal protective equipment; and
- Assist in the investigation of accidents, spills and near misses within their department's laboratory.

3.0 Standard Operating Procedures

The University supports the implementation of prudent laboratory practices when working with chemicals in a laboratory. These include general and laboratory-specific procedures for work with hazardous chemicals, emergency procedures and laboratory waste procedures. Procedures have been put in place to protect laboratory personnel from health hazards and physical hazards within the University laboratories. In addition to this document, further requirements in department specific laboratories can be found in appendices A, B and C.

3.1 Laboratory General Safety Procedures

The University has established general lab procedures to ensure that laboratory personnel maintain healthy and safe work practices in laboratory. All laboratory personnel working in laboratories must adhere to the following policies when laboratory work involves the use of hazardous chemicals. Failure to do so will be reported to the CHO.

- Always read and understand the safety data sheet (SDS) for the chemicals you work with before handling;
- Do not use broken or chipped glassware, and dispose of it in a designated marked container (e.g., "broken glass only");
- Never pipette by mouth; always use a pipette aid or suction bulb;

- Do not apply cosmetics in the laboratory;
- Wash hands and arms thoroughly before leaving the laboratory, even if gloves have been worn;
- Food and drink are forbidden in the laboratory;
- All chemical containers such as test tubes, beakers and flasks must be labeled with the full chemical name; and
- Do not work alone in the laboratory if the procedures being conducted are hazardous.
- Always wear appropriate PPE

3.2 Accident and Incident Reporting

All accidents, incidents and near misses that result in personal injury or illness, damage and/or a potential for significant injury or property loss to University property shall be properly reported within 24 hours through use of the University's Accident/Incident Report Form and submitted to ehs.safety@newhaven.edu. All accidents or near misses should be carefully investigated by Environmental Health and Safety with the results distributed to all who might benefit.

If emergency care is needed, the University Campus Police have licensed Emergency Medical Technicians (EMT) on each shift. An EMT is on duty 24 hours a day, seven days a week to handle the University's emergency medical needs. The EMT service works in cooperation with the Health Services Department as well as the Allingtown Fire Department. An EMT can be requested by calling the Campus Police Emergency Line at 203.932.7070 or extension 7070.

3.3 Chemical Storage

- All chemicals in the laboratory should have a designated storage area and should be returned after each use or at the end of each class whichever occurs first;
- Avoid storing chemicals on bench tops and floors;
- Storage trays or secondary containers should be used to minimize spillage of material if a container breaks or leaks;
- Avoid storing virgin chemicals in the fume hood because containers and equipment can interfere with airflow, clutter the work space and increase the amount of material that could become involved in a hood fire;
- Avoid storing chemicals in direct sunlight or near a heat source;
- Physically separate incompatible chemicals using a secondary containment bin or tray and/or

store at another designated location;

- All chemical containers must be properly labeled and stored in designated storage areas;
- Avoid storing hazardous chemicals above eye level; and
- Refrigerators used for storage of flammable chemicals must be explosion-proof, laboratory-safe units.

3.4 Hazardous Waste Management and Disposal

The University will collect and dispose of hazardous waste in accordance with local, state and federal hazardous waste regulations.

The CHO will periodically monitor and arrange for pick-up/clean out of both the satellite accumulation areas (SAA) and main accumulation areas (MAA).

3.4.1 Management

Hazardous waste chemicals regulated by the Environmental Protection Agency and Connecticut Department of Energy and Environmental Protection must be collected, labeled, packaged and disposed of according to federal and state hazardous waste regulations. Hazardous waste is any solid, liquid, sludge or containerized gas that is discarded, has served its intended use, or is manufacturing by-product, and exhibits any of the characteristics identified below:

- Flammable
- Corrosive
- Reactive
- Toxic

It is the responsibility of the waste generator to adhere to proper waste management and disposal policies. Hazardous waste shall be collected in an appropriate container pending transfer to the MAA or SAA for chemical waste handling or pickup by a licensed third party hazardous waste contractor.

3.4.2 General Procedures for Disposal

- Any material that meets the criteria of a hazardous waste shall not be treated or otherwise changed to alter its characteristics as a hazardous waste;
- Drain disposal of any chemicals is prohibited;
    - Refer to Appendix A for ***Bleach Disinfection for Biosafety Level 1 & 2 Liquid Waste for Drain Disposal.***

- Containers collecting waste deemed to be hazardous must be labeled with a University approved hazardous waste label at the time the first drop is added to the collection container;
- Empty containers of hazardous materials shall be rinsed three times before disposal. The first rinse shall be collected as hazardous waste;
    - Empty containers of acutely hazardous wastes (p-listed) must be collected as hazardous waste, or can be triple rinsed with all three rinses being collected as hazardous waste.
- Dispose of all waste in designated, labeled containers. Any questions about proper disposal methods should be directed first to the designated laboratory manager and then to the Associate Vice President of Public Safety & Administrative Services;
- Do not combine different waste streams (i.e. biohazardous and hazardous or incompatible hazardous materials);
- Do not overfill containers; and
- Manage common laboratory waste (uncontaminated gloves, paper towels, etc.) in the general trash.

3.4.3 Storage and Handling for Hazardous Waste

- All hazardous waste generated at University must be accumulated and stored in a SAA before being transferred to the MAA;
- The SAA's are marked by a sign defining the SAA. The area is used for the accumulation of waste generated at the point of generation;
- All SAA waste containers must be labeled with SAA labels or the words "Hazardous Waste" with the full chemical name and hazard class (e.g. flammable);
- When a SAA waste container becomes full, date the container with the 'full date' and inform the laboratory manager;
- SAA containers can remain in the SAA indefinitely or until they become full. Full containers must be moved into the MAA within three days of the full date;
- All containers must be closed and sealed when not in use;
- Waste must be stored in containers compatible with the constituents of the waste;
- MAA's are located within secure areas in the Chemistry, Biology and Forensics departments and must remain locked at all times; and
    - The Dental department does not have a MAA and has been trained to call the Associate Vice President of Public Safety & Administrative Services once their collection containers have become full.

- Secondary containment bins must be used to prevent mixing of incompatible waste streams.

3.4.4 Lab-Pack Chemicals

Expired or unwanted chemicals should not remain in chemical stock areas; they should be appropriately labeled with hazardous waste labels and moved to the MAA for pick-up by a licensed hazardous waste hauler.

3.4.5 Biological Waste

Biological waste is characterized as waste which may pose a health hazard. Biological waste consists of contaminated animal carcasses, needles and syringes, cell culture wastes and any biologically contaminated laboratory debris. All biohazardous waste must meet the following criteria prior to disposal:

- Waste shall be placed in red bio-waste bags marked with the universal biohazard symbol;
- Do not place leaking or liquid waste into the bags;
- All biohazardous sharps should be disposed of in a red sharps container labeled with the universal biohazard symbol;
- Do not overfill bags; and
- Do not leave or dispose of red bio-waste bags near the general trash.

3.4.6 Sharps Disposal

- All contaminated sharps (needles, syringes, broken glass, razor blades, glass pipettes, etc.) shall be disposed of in an approved sharps container;
- All needle/syringe assemblies are to be disposed of intact. In order to prevent needle stick injuries, needles are not to be recapped, bent or broken;
- All used needles and syringes are considered contaminated sharps and should be disposed of in sharps containers;
- Syringes/needles used with potentially infectious materials shall be disinfected prior to being placed into the sharps container; and
- When the sharps container is full, cap the top of the container and affix the cap with tape. Notify building services to schedule a pick-up and disposal.

3.4.7 Broken Glass Disposal

- Broken glass and sharp objects shall never be disposed in general trash receptacles, autoclave

bags or recycling bins.

- Glass bottles (not eligible for recycling) shall be triple rinsed with water and their labels defaced before discarding.
- Glass bottles or broken glass must be disposed of in cardboard "Deposit Glass Here' boxes. These boxes are available in each academic laboratory.
- Seal the top of the box closed with tape when it is full and label it 'trash'.

3.4.8 Universal Waste Management

- Fluorescent lamps, cathode ray tube (CRT) screens, Nickel Cadmium or rechargeable batteries, and mercury containing devices such as thermostats are classified as Universal Waste in Connecticut and cannot be disposed in the general trash. For disposal contact the Facilities Department.

3.5 Chemical Procurement

Before a chemical is received, information on proper handling, storage and disposal should be reviewed by consulting the safety data sheet (SDS). No container should be accepted without an adequate label. Preferably, all chemicals should be received in one central location.

3.6 Chemical Inventory Control

Each department (Chemistry, Biology, Forensics, Dental Hygiene, Fire Science, Engineering, Facilities) will maintain an accurate chemical inventory for each classroom, laboratory and main chemical storage area. Inventory lists are maintained on MSDSOnline and will be made available upon request.

3.7 Housekeeping

- Laboratory fume hoods and work areas should be kept clean and free of debris at all times;
- Do not allow trash to accumulate in any area. It can be a fire hazard and or obstruct emergency equipment and egress;
- Do not store food or drink in any chemical laboratory; and
- Access to exits, emergency equipment and utility controls should never be blocked.

3.8 Emergency Procedures

In the event of a hazardous materials spill or incident in which assistance is needed, the following steps must be followed.

- If the incident is indoors, close all doors in order to isolate the area if it safe to do so.
- From a safe area call the University Campus Police department at 203.932.7070 or extension 7070 and provide them with the following information:
    - Location of the incident;
    - If anyone has been injured or exposed to the spilled material;
    - If a fire or explosion is involved with the incident
    - Name of the spilled material;
    - Quantity of the material spilled;
    - Time of the incident;
    - Your name, phone number and location.
- Follow instructions provided by the emergency responders; and
- If necessary, evacuate the area.

3.9 Hazard Assessment

A hazardous chemical means a chemical for which there is statistically significant evidence that acute or chronic health effects may occur in exposed laboratory personnel. An acute health effect is an adverse health effect characterized by severe symptoms that develop rapidly. A chronic health effect is an adverse health effect with symptoms that develop slowly over a relatively long period of time.

A hazard assessment located on MyCharger must be completed to identify the physical and health hazards of chemicals used in the laboratory and determine the risk of exposure to the body. A physical chemical hazard is a chemical that is proven to be a combustible liquid, flammable, a compressed gas, explosive, an organic peroxide or an oxidizer. A health hazard means a chemical for which there is statistically significant evidence that acute or chronic health effects may occur in exposed employees.

A hazard assessment should include: identifying the hazard type (s), selection of appropriate PPE, training laboratory personnel, storage and handling requirements, control measures, signs and symptoms of an exposure, and spill and decontamination procedures.

3.10 Bonding and Grounding

Bonding and grounding of flammables is extremely important to reduce the risk of explosion and fire due to static electricity that builds up during the transfer of flammable liquids. Bonding prevents the generation of static electricity by minimizing the electrical potential between two objects, such as a dispensing drum and a safety can. Grounding minimizes the electrical potential between the containers and the ground. Bonding and grounding shall be used when transferring Class I flammable liquids, those with a flash point below 100 F (ethyl ether, benzene, xylene, and acetone) in metal equipment in order to avoid static generated sparks.

3.11 Procedures for Prior Approval

Whenever there is a significant change in chemical amounts, new equipment, a situation where one must work alone or highly hazardous chemicals or procedures, approval must be given by the applicable department chair prior to starting procedure. General safety considerations include:

- Experimental design;
- Equipment design;
- Work space adequacy;
- Development of an SOP;
- Work preparedness; and
- Hazard assessment.

3.12 Procedures for Particularly Hazardous Substances (Select Carcinogens, Reproductive Toxins, Highly Toxic Chemicals, and Chemicals of Unknown Toxicity)

The following procedures must be followed when performing laboratory work with particularly hazardous substances.

- These substances must be used and stored only in areas with restricted access.
- Designated area may be used for work with these materials and may be the entire laboratory, a glove box, an area of a laboratory, or a device such as a chemical fume hood. The designated area must be clearly posted with signs that;
    - Identify the hazards;
    - When the hazardous material is in use;
    - No untrained personnel allowed in the work area; and
    - Clearly define the designated area.
- Only the smallest amount of a chemical required by the procedure shall be used or stored.

- When possible, only order the required amounts to avoid unnecessary decanting or weighing out the material.
- Specific spill procedures for the hazardous materials must be developed and posted in the designated area.
- All laboratory personnel working with these chemicals shall be familiar with the hazards and proper procedures for accidental release.
- General PPE to be worn at all times when working with this materials are safety glasses, gloves, long sleeve laboratory coats, and no open toed shoes.
- The designated work area shall always be decontaminated after each process, experiment, or when the work is completed.
- All waste products from the process shall be managed in a compatible container.

4.0 Special Procedures for Handling Hazardous Chemicals

The CHO shall ensure that all lab personnel are aware of the locations, hazards and appropriate control measures for work involving hazardous chemicals. In some cases, laboratory-specific procedures may be required for working with highly hazardous materials. Review the SDS for specific handling and storage requirements of hazardous chemicals. Some specific hazards that may be present in various laboratories at the University are listed below.

4.1 Allergens and Sensitizers

A chemical allergy is an adverse reaction by the immune system to a chemical. Allergic reactions result from previous sensitization to a chemical or a structurally similar chemical. Once sensitization occurs, allergic reactions can result from exposure to extremely low doses of the chemical. Allergic reactions can be immediate, occurring a few minutes after an exposure. Anaphylactic shock is a severe immediate allergic reaction that can result in death if not treated quickly. Allergic reactions can also be delayed, taking hours or even days to develop. It is important to recognize that a delayed chemical allergy can occur even some time after the chemical has been removed. Examples of substances that may cause allergic reactions include diazomethane, formaldehyde, various isocyanates, benzylic and allylic halides and certain phenol derivatives.

4.2 Asphyxiants

Asphyxiants are substances that interfere with the transport of an adequate supply of oxygen to the vital organs of the body. Simple asphyxiants are substances that displace oxygen from the air being

breathed to such an extent that adverse effects result. Acetylene, carbon dioxide, argon, helium, ethane, nitrogen and methane are common asphyxiants. It is important to recognize that even chemically inert and biologically benign substances such as carbon monoxide can be extremely dangerous under certain circumstances.

4.3 Compressed Gas

Gas cylinders contain either compressed liquids or gases. Gas cylinders represent the most insidious hazard, as puncture, heat, faulty valves, pressure or regulators may result in a rapid release of the entire contents. The following safety considerations should be implemented where applicable:

- The cylinder contents must be clearly identifiable.
- Handle cylinders carefully and do not roll, slide, or drop. Use a cart or hand truck to transport.
- Do not lift a cylinder by its cap.
- Secure all cylinders while in storage, transport, or use.
- Never tamper with cylinder valves, force connections, or use homemade adapters. Use only approved equipment. Never repair or alter cylinders, valves, or safety relief devices.
- Only use a regulator compatible with the cylinder contents.
- Close the cylinder valve when not in use.
- When empty, turn off the cylinder valve and label the cylinder as empty. Store separately from full cylinders.
- Store cylinders in a well ventilated area away from ignition sources, heat, flames, and flammable chemicals.
- Keep the protective caps on the cylinders at all times except when the cylinders are in active use.
- Check for gas leaks using soapy water around the connections.
- Do not store flammable gas cylinders with oxidizers such as nitrous oxide or oxygen. They must be separated by a minimum of 20 ft. or a 5 foot fire wall.

4.4 Corrosive Chemicals

The Resource Conservation and Recovery Act (RCRA) defines a corrosive chemical as a liquid with a pH ≤2 or >12.5. Acids and bases can cause severe tissue damage depending on the corrosivity of the chemical. The primary means of protection from corrosive chemicals is the use of gloves, goggles, face shields, aprons, lab coats and other chemical resistant clothing. Exercise extreme caution when handling corrosive chemicals. The following safety considerations should be implemented where applicable:

- Transport acids and bases in a bottle carrier or cart. Do not handle by the neck alone; support the weight of the bottle from the bottom when handling or pouring.
- Do not store acid and bases with flammable liquids or oxidizing chemicals. Store perchloric acid by itself.
- Isolate corrosive chemicals from incompatible chemicals.
- Reference the chemical's SDS for proper handling, PPE, and storage requirements.
- If an acid or base comes in contact with your skin or clothing, thoroughly wash the affected areas utilizing the safety showers or eyewash units.

4.5 Cryogenic Liquids

Cryogenic liquids are liquefied gases that are kept in their liquid state at very low temperatures and are associated with various hazards including: extreme cold, asphyxiation, explosion, cold contact burns, and toxicity. The most common cryogenic liquids at the University include oxygen and nitrogen. Laboratory personnel should be thoroughly trained on the hazards and the proper steps to avoid them. Training should include emergency procedures, operation of equipment, safety devices, appropriate engineering controls, knowledge of the properties of the materials used, and personal protective equipment required. Insulated gloves should always be worn when handling anything that comes into contact with cryogenic liquids or the vapors. Considerations must be made to prevent cryogenic material from contacting skin. Clothing such as a lab coat, pants, closed toed shoes, safety glasses, goggles, and face shields should be worn.

4.6 Flammable and Combustible Chemicals

Flammable chemicals are considered to be liquids with a flashpoint below 100 °F and solid materials that readily sustain combustion. Liquids with a flashpoint between 100 °F and 200 °F are generally classified as combustible; the same basic procedures should be applied when handling combustible liquids.

- Do not allow smoking or other sources of open flames in areas where flammable chemicals are used.
- Know the location fire extinguishers, fire alarms, and emergency exits in the laboratory.
- Do not store flammable liquids in domestic-type refrigerators. Use only refrigerators rated for flammables.
- Do not store flammables with oxidizing agents (e.g., nitric and sulfuric acids).
- Do not expose flammable liquids to potential sources of ignition such as electrical equipment,

heat, burners, or open flames.

- To prevent accidental electrical charge, the use of bonding and grounding equipment should be used whenever applicable. The use of non-sparking tools can prevent an ignition source.
- Store flammable liquids in an approved fire rated flammable storage cabinet.
- Do not store flammable liquids on the floor, unless protected by secondary containment.
- Minimize the amount flammable liquids that are in use, being stored, and that are generated as wastes.
- Storage of flammable liquids greater than 10 gallons within a laboratory fire area must be in an approved and labeled flammable storage cabinet.
- The SDS shall be reviewed by the owner/user of the materials for additional safety requirements and precautions.

4.7 Irritants

An irritant is a chemical, which is not corrosive, but which causes a reversible inflammatory effect on living tissue by chemical action at the site of contact. A wide variety of organic and inorganic chemicals are irritants; thus, skin contact with all laboratory chemicals should be avoided. Use a properly functioning chemical fume hood when handling irritants that can be inhaled. At minimum, safety glasses, lab coat, long pants, protective gloves, and closed toed shoes should be worn.

4.8 Organic Peroxides

Organic peroxides are hazardous because of their extreme sensitivity to shock, sparks, heat, light, strong oxidizing and reducing agents, and other forms of detonation. Organic peroxides may cause fire, create explosion hazards, and may be toxic or corrosive. Some organic peroxides are dangerously reactive, decomposing very rapidly or explosively if they are exposed to slight heat, friction, mechanical shock or contamination with incompatible materials. Precautions for handling peroxides should include the following:

- Limit the quantity of peroxides.
- Store away from sunlight and increased temperatures; avoid humidity. Keep containers capped, clean, and undamaged.
- Do not return unused peroxides to the container.
- Clean up all spills immediately. Solutions of peroxides can be absorbed using vermiculite or other absorbing materials.
- Do not permit smoking, open flames, and other sources of heat near peroxides. Areas should be labeled that contain peroxides so that this hazard is evident.

- Avoid friction, grinding, and other forms of impact near peroxides, especially solid peroxides. Glass containers that have screw-cap lids or glass stoppers should not be used. Polyethylene bottles that have screw-cap lids may be used.
- Isolate from incompatible materials such as strong acids and bases, flammable and combustible liquids, and reducing agents.

4.8.1 Peroxide Formers

Peroxide formers are compounds that can potentially change to form Organic Peroxides. As such, the recommendations for storing Organic Peroxides should apply to Peroxide Formers.

- There are three categories of Peroxide Formers
    - List A contains compounds that can form peroxides while stored; such as, vinyl monomers and potassium metal
    - List B contains compounds that can form peroxides from concentration; such as, ether and dioxane.
    - List C contains compounds that can form peroxides via polymerization reaction; such as vinyl monomers.
- Peroxides may have formed if one detects
    - Increased viscosity
    - Changes in color
    - Formation of crystals

4.9 Oxidizers

Oxidizers are chemicals other than a blasting agent or explosive as defined in § 1910.109(a), that initiates or promotes combustion in other materials, causing fire either of itself or through the release of oxygen or other gases. Precautions for handling oxidizers should include the following:

- Minimize the amount of oxidizers used and stored.
- Isolate from incompatible chemicals (e.g., organics, flammable, dehydrating, or reducing agents).
- Do not store oxidizers in wooden cabinets or on wooden shelves.
- Do not return unused material to the original container.
- Store in a tightly closed container and in a cool, dry, ventilated area.

4.10 Pyrophoric Chemicals

Pyrophoric chemicals are extremely reactive toward oxygen and/or water and must never be

exposed to the atmosphere. Examples include sodium hydride and magnesium. Exposure of these chemicals to the air could result in spontaneous combustion, which could cause serious burns or other injuries to the person handling the chemical or others in the immediate area. In addition, all combustible materials, including paper products, should not be allowed to come in contact with any pyrophoric at any time. Pyrophoric material can be handled and stored safely as long as all exposure to atmospheric oxygen and moisture is avoided. Solids must be transferred under an inert atmosphere in an efficient glove box. Glass bottles of pyrophoric material should not be handled or stored unprotected. The metal container shipped with each bottle should be retained as a protective container for each bottle for transporting and storage.

4.11 Reproductive Toxins

Reproductive toxins are chemicals which affect the reproductive capabilities including chromosomal damage and effects on fetuses. Reproductive toxins have adverse effects on various aspects of reproduction, including fertility, gestation, lactation, and general reproductive performance. Reproductive toxins can affect both men and women. Reproductive toxins include lead, carbon disulfide and mercury.

4.12 Toxic Chemicals

Toxic is defined by OSHA 29 CFR 1910.1200 as a chemical which falls in any of these three categories:

- A chemical that has a median lethal dose (LD50) of more than 50 milligrams per kilogram but not more than 500 milligrams per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.
- A chemical that has a median lethal dose (LD50) of more than 200 milligrams per kilogram but not more than 1,000 milligrams per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between two and three kilograms each.
- A chemical that has a median lethal concentration (LC50) in air of more than 200 parts per million but not more than 2,000 parts per million by volume of gas or vapor, or more than two milligrams per liter but not more than 20 milligrams per liter of mist, fume, or dust, when administered by continuous inhalation for one hour (or less if death occurs within one hour) to albino rats weighing between 200 and 300 grams each.

4.13 Unknown Chemicals

Unknown chemicals, or those for which complete physical and chemicals hazards are not known, must be assumed to be hazardous and highly toxic. Should an unknown chemical be identified, the CHO and Associate Vice President of Public Safety & Administrative Services should be notified immediately.

5.0 Control Measures

For the laboratory use of OSHA regulated substances, the University shall assure that laboratory personnel exposure to such substances do not exceed the permissible exposure limits (PEL) specified in 29 CFR 1910, subpart Z. To minimize laboratory personnel exposure to hazardous chemicals the following control measures should be implemented:

- Substitution of less hazardous chemical or processes
- Engineering controls
- Administrative controls
- Personal protective equipment (PPE)

Substitution, engineering controls, administrative controls, and personal protective equipment (PPE) are basic principles used to control hazards and exposures. Before the proper control (s) can be selected, a hazard assessment of the process, activity, or material should be conducted.

5.1 Substitution

Every hazard assessment should first determine if the hazardous conditions can be prevented, e.g., substituting with a less hazardous chemicals or process. Substitution is one of the most effective ways to eliminate or reduce exposures because it removes the hazard at the source.

5.2 Administrative Controls

Administrative controls are changes in work procedures such as written safety guidelines, rules, supervision, schedules, signs, labels, SDS's, and training to reduce employee exposure to hazardous chemicals.

5.2.1 Safety Data Sheets (SDS)

SDS's are documents created by the chemical manufacturer that describe the substance. Some information found on an SDS includes: chemical and physical characteristics, handling requirements, storage and disposal information, and signs and symptoms of exposure. SDS's are required for all chemicals at the University and must remain on file for 30 years after employment.

OSHA requires up-to-date SDS's that are readily available for each chemical. The Facilities Department is responsible for obtaining SDS's for chemicals used and stored within their department and the CHO is responsible for obtaining SDS's within the laboratory areas at the University**.** SDS's shall be uploaded to MSDSOnline to ensure accessibility to all personnel and regulatory inspectors as needed. Laboratory personnel have a right to access any or all SDS's.

5.2.2 Signs and Labels

All hazardous materials, hazardous waste and chemical storage areas shall be appropriately labeled indicating the hazards present and any other relevant regulatory requirements. All chemical containers at the University must be labeled regardless of size and whether or not they are hazardous. Labeling of all chemical containers assists emergency personnel and others in identifying what is and what is not hazardous should a spill occur or other emergency situation arise. Original labels on chemical containers must not be removed or defaced. Labels must be in English and they must contain the complete name of the chemical and be traceable or easily linked to the appropriate SDS (chemical formulas are not allowed). The manufacturer's label is generally sufficient to meet OSHA labeling requirements and should be replaced only if it becomes damaged or illegible. All containers into which chemicals are transferred also need to be legibly labeled in English and include the name of the chemical and appropriate hazard warnings (chemical formulas are not allowed). In addition to OSHA's Globally Harmonized System pictograms, the National Fire Protection Association (NFPA) 704 diamond may be utilized. The NFPA system requires the chemical name to be listed along with health, flammability, reactivity and specific hazard ratings. Refrigerators or freezers containing either chemicals or food should be appropriately labeled, e.g., chemicals only, no food or drink, or food and drink only.

All laboratories shall be posted with signage addressing the hazards of the materials contained in the lab, requirements for personal protective equipment, and any special hazards located in the lab.

5.3 Engineering Controls

Engineering controls eliminate or reduce exposure to a chemical or physical hazard through the use or substitution of engineered machinery or equipment. Engineering controls include process change, substitution, isolation, ventilation, and source modification.

- **Process change** consists of changing a process to make it less hazardous (e.g., paint dipping in place of paint spraying).
- **Substitution** consists of substituting for a less hazardous material, equipment, or process (e.g., use of soap and water in place of solvents, use of automated instead of manually operating equipment).
- **Isolation** is applied when a barrier is inserted between a hazard and those who might be affected by that hazard. Separating personnel from hazardous operations, processes, equipment, or environments using a physical barrier or distance may provide the necessary isolation.
- **Ventilation** can be either local (direct air movement) or general (dilution of air contaminants) that exhausts or supplies air properly.
- **Source modification** consists of changing a hazard source to make it less hazardous (e.g., wetting dust particles or lowering the temperature of liquids to reduce off-gassing and vaporization).

5.4 Personal Protective Equipment (PPE)

The University is required to determine if PPE should be used to protect their laboratory personnel. PPE should be used in conjunction with guards, engineering controls and administrative controls. PPE may be required to reduce laboratory personnel exposure to hazards when engineering and administrative controls are not feasible or effective in reducing these exposures to acceptable levels. PPE should always be worn if there is a possibility that personal clothing could become contaminated with hazardous materials. Examples include: laboratory coats, aprons, jumpsuits, boots, shoe covers, and gloves. Review SDS's to determine the necessary PPE to limit exposure. The kind of PPE needed depends on how the chemical enters the body. This is called route of exposure and is listed on the SDS. The four major routes of exposures are skin absorption, inhalation, ingestions and injection.

5.4.1 Eye and Face Protection

Safety glasses with side shields that conform to ANSI standard Z87.1-1989 are required for work with hazardous chemicals. Ordinary prescription glasses with hardened lenses do not serve as safety glasses. If prescription safety glasses are needed, please contact the Associate Vice President of Public Safety & Administrative Services**.** Although safety glasses can provide protection from injury from flying particles, they offer little protection against chemical splashes. Splash goggles should be worn if there is a splash hazard in any operation involving hazardous chemicals. Full face shields are worn in conjunction with either safety glasses or splash goggles. When there is a possibility of liquid splashes, both a face shield and splash goggles should be worn; this is

especially important for work with highly corrosive liquids. Full-face shields with throat protection and safety glasses with side shields should be used when handling highly hazardous chemicals. If work in the laboratory could involve exposure to lasers, ultraviolet light, infrared light, or intense visible light, specialized eye protection should be worn. Safety glasses should be provided for visitors in the laboratory.

5.4.2 Hand Protection

When handling hazardous chemicals, laboratory personnel shall select and wear the appropriate gloves. No single glove can provide appropriate protection in every work situation. It is important to assess the hazards in each task and select a glove that provides the required protection. Below are general recommendations for glove selection and use:

- Similar gloves supplied by different manufacturers may not offer the same level of protection; therefore, the manufacturer's glove selection chart may need to be reviewed.
- Select gloves which are resistant to the chemicals you may be exposed to. Consult the relevant SDS which may recommend a particular glove material.
- Select gloves of the correct size and fitting; gloves that are too small are uncomfortable and may tear whereas larger gloves may interfere with dexterity.
- Before use, check gloves (even new ones) for physical damage such as tears and pin holes.
- When removing gloves, do so in a way that avoids the contaminated exterior contacting the skin.
- Wash hands after removing gloves.

Many factors affect the breakthrough times of gloves including: thickness of glove material, chemical concentration, amount of chemical that comes into contact with the glove, length of time the glove is exposed to the chemical, temperature at which the work is done, and possibility of abrasion or puncture. Glove selection guides are available from most manufacturers.

If chemicals do penetrate the glove material, they could be held in prolonged contact with the hand and cause more serious damage than in the absence of a proper glove. Gloves should be replaced immediately if they are contaminated or torn. The use of double gloves may be appropriate in situations involving chemicals of high or multiple hazards. Leather gloves are appropriate for handling broken glassware and inserting tubing into stoppers, where protection from chemicals is not needed. Gloves should be decontaminated or washed appropriately before they are taken off and should be left in the laboratory and not be allowed to touch any uncontaminated objects in the

laboratory or any other area. Gloves should be replaced periodically, depending on the frequency of use.

5.4.3 Lab Coats, Protective Suits & Aprons

Appropriate laboratory coats should be worn, buttoned, with the sleeves rolled down. Laboratory coats should be fire-resistant and fully covering. Laboratory coats or laboratory aprons made of special materials are available for high-risk activities. Laboratory coats that have been used in the laboratory should be left there to minimize the possibility of spreading chemicals to eating and office areas, and they should be cleaned regularly. Rings, bracelets, watches, or other jewelry that could trap chemicals close to the skin, come in contact with electrical sources, or get caught in machinery should not be worn. Leather clothing or accessories should not be worn in situations where chemicals could be absorbed in the leather and held close to the skin.

5.4.4 Laboratory Attire

When performing work with hazardous materials, laboratory personnel should cover all exposed parts of their body to prevent unnecessary chemical exposure. Tie long hair back, avoid loose clothing such as neckties and flowing sleeves.

5.4.5 Foot Protection

Closed toed shoes should be worn in areas where hazardous chemicals are in use or mechanical work is being done. Clogs, perforated shoes, bare feet, sandals, and cloth shoes do not provide protection against chemicals. Shoe covers may be required for work with especially hazardous materials.

6.0 Equipment, Maintenance, and Inspections

6.1 Fume Hoods

The laboratory fume hood is the most common local exhaust method used in laboratories. When working with hazardous chemicals, the use of the fume hood is required at the University. A properly operating and correctly used fume hood will control vapors, dusts, and mists released from volatile liquids. Fume hoods can also protect from accidental spills. Fume hoods are inspected and certified annually by a third party contractor. However all laboratory staff are responsible for ensuring that their fume hood(s) has an updated certification label and is functioning properly. Except when adjustments to the apparatus are being made, the hood should be kept closed, with

vertical sashes down and horizontal sashes closed, to help prevent the spread of a fire, spill, or other hazards into the laboratory. Basic guidelines for operating a fume hood include the following:

- Confirm that the fume hood has been certified within the last year (label with date).
- Confirm that the chemical can be used in the fume hood.
- Conduct procedure at least six inches behind the plane of the sash.
- Never put your head inside a fume hood to check an experiment.
- Work with the sash at the lowest position possible to protect your face and body.
- Do not clutter the fume hood with bottles, chemicals, or equipment as it restricts airflow and work space.
- Immediately report any suspected fume hood malfunctions to the Manager of Facilities Operations.
- Limit foot traffic behind while performing operations in the hood.

6.2 Safety Showers and Eyewash Stations

In case of an exposure to hazardous substances, a reliable, clean source of water must be available to rinse contaminants from the body. Safety showers, drench hoses and eye wash stations are either located in each of the laboratories or in adjacent corridors. Laboratory staff must ensure that safety showers and eyewash stations are free from obstruction. Laboratory staff and professors are responsible for ensuring all laboratory personnel are aware of the nearest safety shower and eyewash station location and how to use the device. A member of the University Facilities Department is responsible for inspecting and testing of the eyewash and drench hose stations at least monthly.

The safety showers will be tested at least twice a year by the Facilities Department. Additional testing information can be found in the university's Eye Wash and Safety Shower Inspection Policy and Procedure.

6.3 Inspections

The Associate Vice President of Public Safety & Administrative Services will coordinate routine laboratory safety inspections. Inspections will include a walk-through of the selected area(s) and will cover lab safety, PPE, waste management, and related topics. Area representatives should use the results as a guide to identify and correct similar and/or other environmental, health and safety issues in their area(s).

7.0 Information and Training

7.1 Information

The University will provide the following information to laboratory personnel prior to working with any chemical:

- The availability and location of the CHP.
- SDS's for all hazardous chemicals the employee will use.
- Standard Operating Procedures (SOP's) for all of the operations the employee will conduct.
- A description and use of the University labeling system.
- Additional information on the hazards, safe handling, storage and disposal of hazardous chemicals can be obtained from the CHO, Prudent Practices in the Laboratory, OSHA website, NIOSH website and the chemical manufacturers.

7.2 Training

All employees working in a laboratory shall be trained to the contents of the CHP and all applicable SOPs that are pertinent to a procedure, experiment, or task. Training shall include but is not limited to:

- Provisions of the CHP;
- Hazards in the laboratory;
- OSHA regulated substances or recommended exposure limits;
- Signs and symptoms associated with exposures to hazardous chemicals;
- Safe handling, storage, and disposal of hazardous chemicals;
- How to read an SDS; and
- The selection and use of PPE.

7.3 Frequency of Training

Training shall be provided for laboratory personnel prior to starting work in the laboratory; before each new possible hazard exposure; before use on new or altered equipment; and on changes to SOP's or the CHP. Refresher training is required annually.

7.4 Recordkeeping

The Associate Vice President of Public Safety & Administrative Services is responsible for establishing and maintaining records for employee training, employee environmental monitoring and compliance records.

8.0 Medical Examinations and Consultations

The University shall provide all laboratory personnel who work with hazardous chemicals the opportunity for medical attention and follow-up by a competent physician if they show signs and symptoms of exposure.

8.1 Medical Surveillance

All laboratory personnel shall be provided an opportunity to receive an appropriate medical examination performed by a licensed physician at a reasonable time and free of cost under the following circumstances.

- At any time laboratory personnel believe they have been significantly exposed to hazardous materials.
- Whenever laboratory personnel develop signs or symptoms associated with a hazardous chemical to which they may have been exposed in the laboratory
- If an event takes place in the work area such as a spill, leak, explosion or other occurrence resulting in the likelihood of a hazardous exposure.
- Where exposure monitoring reveals an exposure level routinely above the action level for an OSHA regulated substance.

8.2 Information Provided to the Physician

The University shall provide the following information to the physician:

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

8.3 Physician's Written Opinion

The University shall obtain a written opinion from the examining physician which shall include the

following:

- 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 laboratory personnel at increased risk as a result of exposure to a hazardous workplace.
- A statement that the laboratory personnel have 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 written opinion shall not reveal specific findings of diagnoses unrelated to occupational exposure.

Appendix A

Bleach Disinfection of Biosafety Level 1 and 2 Liquid Waste for Drain Disposal

Effectiveness: Bleach, a sodium hypochlorite solution (NaOCl), is a broad-spectrum disinfectant that is an effective disinfectant for:

- Enveloped viruses (e.g., HIV, HBV, HSV)
- Vegetative bacteria (e.g., Pseudomonas, Staphylococcus, and Salmonella)
- Fungi (e.g. Candida)
- Mycobacterium (e.g., M. tuberculosis and M. bovis)
- Non-enveloped viruses (e.g., Adenovirus and Parvovirus)

Personal Protective Equipment (PPE) (Refer to the disinfectants Safety Data Sheet (SDS) for additional PPE and safe handling and use information)

- Laboratory coat
- Nitrile gloves
- Safety Goggles

Concentration

- The appropriate concentration of sodium hypochlorite for disinfecting liquid BSL1 and BSL2 waste is 5000 ppm, approximately 0.5%. Household bleach is 5.2 - 6.1 % sodium hypochlorite; therefore, a 1:10 (v/v) dilution of bleach to liquid biological waste is appropriate.

Contact Time

- An appropriate contact time of sodium hypochlorite with liquid waste is 30 minutes.

Drain Disposal Assessment

- Assess and verify chemical constituents meet drain disposal requirements. Refer to specific Drain Disposal Procedure for additional information (See Below).
    - **Acceptable:** If acceptable for drain disposal and after 30 minutes of contact time, disinfected liquid waste is poured down the sink and flushed with copious amounts of water.

- **Not Acceptable:** If not acceptable, collect and manage waste as chemical waste and provide to EHS for disposal.

Stability and Storage

- Bleach must be stored between 50°F and 70°F. According to Clorox, undiluted household bleach has a shelf life of six months to one year from the date of manufacture. After this time, bleach degrades at a rate of 20% each year, until completely degraded to salt and water. A 1:10 bleach solution has a shelf life of 1 month. Some manufacturer-prepared 1:10 bleach solutions, e.g., Bleach-Rite, contain a stabilizer that increases the shelf life to approximately 18 months. Discount brands of bleach may have lower concentrations of sodium hypochlorite and "colour safe" bleach contains NO sodium hypochlorite (hydrogen peroxide), these products should NOT be used for the disinfection of biological waste.

Procedure for disinfecting and disposing of liquid waste down the drain

1. Work in a well-ventilated area.
2. Label an appropriate container with the type of liquid (Cell Culture, Bacterial, Fungal, Viral, etc.) to be disinfected, your initials, and the date
    - e.g. "Cell Culture Liquid with 10% Bleach – JP – 11/06/2019"
3. Collect the liquid waste so that does not exceed ¾ of the container's volume.
4. Add enough bleach to create a 10% solution (1:10v/v).
5. Let waste sit for 30 minutes. An open container of waste **may not** be left unattended.
6. Dispose of all liquid in the container down the sink drain and flush with a volume of water that is 15-20 times the amount of the liquid waste.
7. If the container will be used to collect additional waste, the labeled container must be secured with a cap and stored under a Biological Safety hood.

DRAIN DISPOSAL REQUIREMENTS

Disinfected biological liquid to be disposed via a drain must:

1. Meet the following characteristics:

- Contains no radioactive materials.
- Contains no biological hazards
- Contains no hazardous waste (Hazardous Waste Reference Guide)
- Liquid not exceeding 5 gallons (19 liters)
- Contains less than 10% solids or viscous substances which are insoluble in water
- Contains less than 50 mg/L (ppm) oils and greases
- Have a pH greater than 5.0 and less than 11.0 or not have any other corrosive property likely to cause damage to structures or equipment of the sewerage

2. Discharge to the sewer via a laboratory sink drain only

3. Flush with copious amounts of water (15-20 times the original volume)

4. Allow the previous disinfected biological liquid to be completely flushed prior to discharging the next disinfected biological waste container.

Appendix B

University *of* New Haven

POLICIES AND PROCEDURES

Do Not Enter

Hazardous Chemical Spill in Laboratory