Gardner-Webb University Chemical Hygiene Plan

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Introduction and Purpose

The Department of Natural Sciences at Gardner-Webb University has developed this Chemical Hygiene Plan to define work practices and procedures to help ensure that all personnel are protected from health and safety hazards associated with the chemicals with which they work. The Chemical Hygiene Plan is part of Gardner-Webb University's compliance with the regulations promulgated on January 31, 1990 by the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) and adopted by North Carolina OSH. This standard entitled "Occupational Exposures to Hazardous Chemicals in Laboratories" is hereafter referred to as the Lab Standard. See Appendix I for information on obtaining or viewing a copy of the Lab Standard. The Chemical Hygiene Plan must include:

- Standard operating procedures
- Criteria to determine and implement specific control measures, such as engineering controls and personal protective equipment
- An ongoing program developed to ensure that fume hoods and other engineering controls are functioning properly
- Information and training requirements
- Circumstances under which a particular laboratory function will require "prior approval"
- Provisions for medical consultation and medical exams;
- Designation of a Chemical Hygiene Officer; and
- Additional precautions for work with select carcinogens, reproductive toxins, and extremely toxic substances.

Definitions

OSHA defines a hazardous chemical as "a chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees." In addition, OSHA defines a laboratory as "a workplace where relatively small quantities of hazardous chemicals are used on a non-production basis." Finally, the Lab Standard applies to employees. OSHA defines an employee as "an individual employed in a laboratory workplace who may be exposed to hazardous chemicals in the course of his or her assignments."

Scope and Application

This document serves as the written guide for compliance with the OSHA Standard. All laboratories within the Department of Natural Sciences at Gardner-Webb University engaged in the laboratory use (as defined by this document) of hazardous chemicals are required to comply with this document.

This Chemical Hygiene Plan must be read by all laboratory workers prior to the commencement of lab duties. In addition to the Plan, laboratory workers must be familiar with and adhere to prudent laboratory safety guidelines developed by their laboratory coordinator, Gardner-Webb University requirements and other relevant regulatory requirements.

A written record stating that each laboratory worker has reviewed the Chemical Hygiene Plan and related health and safety policies and guides must be kept by the Gardner-Webb Chemical Hygiene Officer.

Responsibilities

Gardner-Webb University is committed to providing a safe and healthful environment for all persons associated with the University. Gardner-Webb University intends to be a role model in its environmental stewardship, health protection and safety standards and its compliance with all laws and regulations relating to the environment, health and safety. Gardner-Webb University will provide the necessary resources to achieve these goals.

Gardner-Webb University Administration has the primary responsibility for the health and safety of their employees. Specific responsibilities regarding the implementation of the Chemical Hygiene Plan include:

- Appoint a Chemical Hygiene Officer or Committee who will routinely review the Chemical Hygiene Plan and suggest modifications as needed.
- Make budget arrangements for health and safety improvements.
- Ensure compliance of laboratory workers with this Plan.
- Ensure the availability and enforce the proper use of appropriate personal protective equipment and relevant health and safety reference materials.

Chemical Hygiene Officer's responsibilities include the following:

- Provide technical assistance to laboratory supervisors and others concerning appropriate storage, handling and disposal of hazardous chemicals.
- Inform and train employees concerning chemical safety as required by this Plan. Retain training records and all documentation.
- Provide/arrange general laboratory safety training upon request.
- Alert University administration of the need to conduct exposure assessments and laboratory inspections.
- Provide technical assistance concerning personal protective equipment and laboratory safety equipment.
- Remain current on rules and regulations concerning chemicals used at Gardner-Webb University
- Conduct internal inspections of labs for health and safety concerns and maintain an inspection log of inspection findings.

- Request assistance from the Human Resources Department or University Management, as needed.

- Request allocation of funds from University administration for health and safety improvements, as needed.

Laboratory Coordinator's responsibilities regarding implementation of the Chemical Hygiene Plan include:

- Develop an annual inventory of chemicals present in the laboratory.

- Follow all health and safety standards and rules.

- Ensure proper handling and disposal of all chemicals in his/her laboratories.

- Inform and train student teaching assistants concerning chemical safety as required by this Plan. Retain student training records and documentation.

Professors, Staff, and Laboratory Student Teaching Assistants responsibilities include:

- Ensure that facilities are adequate for the receipt of new substances, train those who will be using the substance, and make arrangements for proper disposal. Procedures established for managing the purchase of chemicals must be followed.

- Report all hazardous conditions to the laboratory coordinator.

- Use prescribed protective equipment.

- Report any suspected job-related injuries or illnesses to the laboratory coordinator and seek treatment immediately.

- Refrain from the operation of any equipment or instrumentation without proper instruction and authorization.

- Remain aware of the hazards of chemicals in the lab and how to handle hazardous chemicals safely.

- Request information and training when unsure how to handle a hazardous chemical or procedure.

Safe Laboratory Practices

The Lab Standard requires operating procedures relevant to safety and health considerations be followed when laboratory work involves the use of hazardous chemicals.

This Plan represents a minimum set of guidelines for the handling of hazardous chemicals in laboratories at Gardner-Webb University. Acceptable lab safety references such as those listed in the OSHA Lab Standard may be adopted in whole or may be useful in developing additional procedures. In all situations, Gardner-Webb University will be responsible for enforcing adequate safety and hygiene measures in the laboratory.

All faculty, students, and others that perform laboratory experiments/research, supervise, or manage others in chemical laboratories must respect and understand the safety and health hazards associated with the chemicals and equipment and practice the following general safety guidelines at ALL times:

Good Laboratory Practices

- Become thoroughly acquainted with the location and use of all safety equipment.
- Know the safety procedures applicable to the work being done. Understand potential hazards and precautions prior to beginning work.
- Proper personal protective equipment must be used. This includes safety glasses at all times.
- Food and drink are prohibited in laboratories.
- Safety guidelines must be communicated to all students prior to any laboratory work. Each student must acknowledge the training by signature and by passing a quiz on the safety information. Everyone working in a laboratory must comply with these safety guidelines.

Guidelines for Chemical Use in Teaching Laboratories

- Large amounts of flammable or corrosive chemicals may not be stored in the teaching labs.
- Minimal amounts of chemicals used for teaching laboratories may be stored for several days while the labs are conducted. All chemicals must be returned to their proper storage areas at the end of each semester.

Food, Beverages & Chemical/Biological Contamination

- Food & beverages are not allowed in any laboratory.
- Lab refrigerators are not used to store food.

- Students should be encouraged to wash their hands with soap & water often and when leaving the lab.
- Students in microbiology should be encouraged to wash their hands with soap and water often to avoid biological contamination.
- Mouth pipetting is not allowed.
- Cosmetics should not be applied in labs.

Housekeeping

- At the conclusion of each lab, students must return all equipment to storage.
- All gas valves must be turned off at the end of each lab session.
- Aisle ways must be clear of obstructions at all times.
- Labs must be maintained in a neat, clean state at all times.
- Floors must be kept clean and dry.

Glassware

- Glassware is stored in student drawers and in stock rooms.
- Glassware that is chipped, cracked, broken, etc must be disposed of and not used.
- Broken glassware is placed in specially designated container labeled for glass disposal.
- When inserting glass tubing into a stopper, lubricate tubing to help prevent glass breakage.

Personal Protective Equipment

Wearing personal protective equipment (PPE) will minimize exposure to hazardous chemicals during routine use and in the event of an emergency. The PPE Hazard Assessment for the Department of Natural Science is shown in Table 1.

- All students, faculty, and staff must wear safety glasses in Chemistry laboratories. Safety glasses must meet ANSI standards.
- All students must wear closed toe shoes and clothes that cover their legs when performing chemistry laboratory experiments.
- PPE requirements for Biology labs are determined by the professor.
- Additional safety equipment may be required and will be determined by the supervising professor.
- Eyewash stations and safety showers are tested minimally once a semester.

Warning Signs/MSDS

- Warning signs must be posted in all labs and chemical storage areas and must alert employees, students, and visitors to the potentially hazardous materials located within.
- Signs must be posted to show the location of all safety equipment including safety showers, eyewash stations, fire extinguishers, telephones, etc.
- Areas where large quantities of highly flammable chemicals are stored and used must be labeled with “no open flames” signs.
- Storage areas for the following classes of chemicals must be appropriately labeled:
  * Toxins
  * Corrosives
  * Flammable liquids
  * Oxidizers
- Signs must be posted showing the location of MSDS books.
- MSDS are maintained for each chemical in inventory. MSDS are kept in the Chemistry and Biology stockrooms.

Unattended Operations

- When an operation is left unattended, the following information must be clearly posted adjacent to the operation: name of emergency contact, title, primary and secondary phone numbers, and brief explanation of any specific hazards associated with the operation.

Working Alone

- Students may not work alone in any laboratory.
- Students wishing to work in laboratories outside of class time must seek approval of a professor and make that professor aware of the proposed activities. With faculty approval, students may work in a lab when someone on that floor is aware of their activities.
- Faculty may work alone in labs after making another responsible adult aware of their plans.

Hazardous Waste Management: General Guidelines

Everyone involved in generating waste has the responsibility to ensure that the waste is properly managed.

Waste Containers

- Containers for the accumulation of chemical waste must be in good condition, free of leaks and compatible with the waste stored in them.
- Provide secondary containment when possible.
- If a container begins to leak, transfer the waste to a container in good condition. Any spilled material must be recovered and added to the new container.
- Waste Containers must be:
    - Clearly marked as waste and with the contents indicated.
    - Maintained near the site of generation and under the control of the lab supervisor.
    - Segregated according to compatibility.
    - Removed by a qualified waste disposal company.
- Do not use biohazard bags for hazardous waste collection.
- CHO maintains records of the disposal.

Personal Use of Chemicals

Do not remove chemicals from the lab for personal use.

Hazardous Material Handling and Storage

Hazards associated with various chemicals and gases vary widely. Understanding the hazards of a compound and minimizing the quantity used and stored in the laboratory will decrease the potential for injury.

General Guidelines

- Eye protection must be worn when handling chemicals.
- Gloves are recommended when working with chemicals.
- Never add water to concentrated acid.
- When possible, students should not be allowed to use concentrated corrosives. If students use concentrated corrosives, they must be made aware of the safety procedures and hazards associated with strong corrosives.
- In the event of contact with eyes or skin, remove affected clothing and flush the area with water. Seek medical help if needed.

Preventing Exposure to Hazardous Chemicals

- As a general rule, no chemicals of known or potential carcinogenic and toxic properties will be used in teaching laboratories.
- When such chemicals are used, a plan of use and disposal must be prepared prior to use. This must include preparation for spills, accidents, and disposal.
- Additional personal protective equipment must be worn including, but not limited to, gloves and a lab coat.

Procurement

Failure to comply with these procedures may result in the removal of the chemical/biological by the Director of Environmental and Occupational Safety.

- Prior to purchasing a chemical, the proper handling and storage information must be known. This information can be obtained from the vendor.
- Prior to the purchase of chemicals/biologicals that do not already have an established waste stream, the purchaser must complete a Chemical/Biological Use Planning Form. The form assists purchasers in ensuring that the chemical/biological will be compatible with the policies of the Department of Natural Sciences and Gardner-Webb University. The purchase can be made only after the form has been approved by the

Chair of Natural Sciences and the Director of Environmental and Occupational Safety.
- Do not receive chemicals without an adequate identification label.
- Those involved in receiving chemicals must have training on spill control procedures.
- MSDS must be obtained for all purchased chemicals.
- All purchased chemicals must be logged into an inventory management system.
- Purchase of any P-listed chemicals is strongly discouraged. In the event that a P-listed chemical is needed, the Director of Environmental and Occupational Safety must be notified of the chemical and amount being purchased. P-Listed chemicals can be found in 40 CFR Part 261.33.
- Purchase of mercury containing compounds is strongly discouraged.

Transport

- Chemicals must be transported in a way that prevents spills or injury to personnel.
- Purchased chemicals may be transported between buildings in the shipping container.
- Due to the close proximity of chemical storage and the labs in Withrow Hall, no special transport guidelines are required between labs and the storeroom.

Chemical Storage

- Chemicals must be segregated by hazard classification and compatibility. Chemicals must be segregated into general inorganic chemicals, general organic chemicals, Oxidizers, Corrosives, Flammables, and Toxins.
- The primary storage facilities for chemicals in Withrow Hall are the Chemistry Stockroom, Biology Stockroom, and Acid Storage Room.
- Storage rooms must be well ventilated and temperature controlled.
- Flammable chemicals are stored in a flammables cabinet.
- Acids are stored in a cabinet designed for corrosives.
- Amounts of stored chemicals must not exceed the capacity of the storage facilities.
- Labels on stored chemicals must be easy to read.
- Chemicals in Refrigerators
    - Household refrigerators are never used to store chemicals of any kind.
    - Refrigerators used for the storage of potentially explosive materials must be explosion proof.
    - All refrigerators used for chemical storage must be labeled as “Chemical Storage Only. No Food Storage”. Non-explosion-proof

refrigerators must include the warning “Do Not Store Flammable Materials in This Refrigerator”.

Labeling

- The following classes of chemical must be labeled: toxins, corrosives, flammables, and oxidizers.
- Chemicals must be labeled with the date of receipt and the initials of the person receiving the chemical.
- Chemicals removed from their original containers must be labeled with the name of the chemical and the hazard class (flammable, oxidizer, etc.).
- Prepared chemical solutions must be labeled with the name of the chemical, concentration, solvent (if not water), preparation date, and the initials of the person who made the solution. *NOTE: The spelled out name of the chemical must be included.*
- Chemicals synthesized must be labeled by the professor supervising the synthesis.

Inventory Control

- An inventory of all chemicals must be maintained.
- An inventory of all chemicals will be conducted once a year, which will include all chemicals in preparation areas, laboratories, and refrigerators.
- Keep the reserve supply of chemicals to a minimum.
- Many chemicals are assigned an expiration date. The expiration date should be strictly observed. Mark expired chemicals for disposal.
- Stored chemicals must be visual inspected annually. Indications that a chemical should be disposed of include:
  - Expired chemicals
  - Slightly cloudy liquids
  - Chemicals that are changing colors
  - Spotting on solids
  - Caking
  - Existence of solids in liquids or liquids in solids
  - Pressure buildup in bottles
  - Evidence of reaction with water
  - Damage to the container
  - Inappropriate labels
  - Leaks
  - Corroded lids

Compressed Gases

Compressed gas is any material or mixture having in the container a pressure exceeding 40 psia at 21ºC, or pressure exceeding 104 psia at 54ºC, or any flammable material having a vapor pressure exceeding 40 psia at 38ºC.

- Treat all gas cylinders as potential explosives.
- Be familiar with the properties of the gas prior to use.
- Always wear eye protection when handling compressed gas.
- Cylinders must be clearly labeled indicating contents.
- Cap gas cylinders when not in use.
- Always use regulators designed for the type of gas in the cylinder.
- Never use lubricant on valve regulators.
- Cylinders must be strapped or chained securely to a wall or bench top to prevent tipping, falling, or rolling

- Storage
    - Inspect new cylinders to ensure that there are no leaks and that proper labels are in place.
    - Store at temperatures no greater than 50ºC.
    - Do not store oxygen with flammable gases.
    - Empty cylinders must be labeled as empty.
    - Store gas cylinders away from heat and sources of ignition.
- Handling and Transportation
    - Use a cart designed for moving gas cylinders, and securely strap the cylinder to the cart for transportation.
    - Valves must be closed and the cover cap secured prior to moving a cylinder. Do not move a tank with the regulator attached.
    - Handle 1 cylinder at a time.
    - Students are not allowed to transport cylinders. Only University Physical Plant personnel are authorized to move cylinders from one floor to another.
- Acetylene
    - Always store upright.
    - Never exceed the pressure limit marked on the regulator in red.
    - For instrument use, never allow the tank to run dry to prevent contamination of the instrument.

Controlling Specific Chemical Hazards & Exposures

The Lab Standard requires the University to determine and implement control measures to reduce employee exposure to hazardous chemicals; and particular attention must be given to the selection of control measures for chemicals that are known to be extremely hazardous. There are four major routes of entry for a chemical to enter the body: inhalation, absorption, ingestion and injection. The types of controls for prevention of these various routes of entry include engineering controls, personal protective equipment and administrative controls.

Corrosives

This includes a broad range of chemical that can damage living tissue. Among these are strong acids and bases.

General Guidelines

- Avoid the use of concentrated corrosives whenever possible.
- Never add water to concentrated acid. Add the acid to water.
- Label all secondary containers as containing corrosives.
- Alert students using corrosives, both concentrated and dilute, to the hazards associated with corrosive materials.
- Gloves are strongly recommended when working with concentrated corrosive materials.
- Mineral acids and bases can be neutralized and disposed of as non-hazardous material.

Storage

- Strong acids must be stored segregated from other chemicals in a protective cabinet.
- Organic corrosives are stored in a separate section within the organic chemical storage area.
- Solid corrosive materials may be stored with the inorganic chemicals when compatible.
- Other corrosives are stored in a protective cabinet.
- Spill kits must be readily accessible where corrosives are stored.
- Maintain as small an inventory of corrosives as possible.

Flammable and Combustible Liquids

Flammable liquids–any liquid having a flashpoint* below 38 °C (100 ° F)
Combustible liquids–any liquid having a flashpoint at or above 38°C (100 ° F)

The flashpoint is defined as the minimum temperature at which a liquid given off vapor in sufficient concentration to form an ignitable mixture with air near the surface of the liquid.

Storage Guidelines

- All containers of chemicals with flash points less than 100°F shall be stored in a flammable storage cabinet. The size and number of such containers will be kept to a minimum.
- The quantities of flammable chemicals stored in teaching laboratories should be kept to minimum unless they are stored in a flammable storage cabinet.
- Appropriate fire extinguishers and/or sprinkler systems and spill control materials will be available in all areas where flammable chemicals are stored.
- Any flammable chemical that must be stored in the refrigerator or freezer must be stored in an explosion proof refrigerator/freezer.

Handling Guidelines

- Use proper PPE.
- Use with proper ventilation.
- Large amounts of flammable chemicals should be used only in vented hoods and away from sources of ignition.
- Smaller working amounts of flammable chemicals should be used in vented hoods whenever possible and away from sources of ignition.
- Heat flammable substances in steam, water, oil, hot air baths or heating mantles only.

Carcinogens, Reproductive Toxins, and Acutely Toxic Chemicals

This category includes substances known or suspected to cause cancer, reproductive toxins and substances that have a high degree of acute toxicity. Some have threshold limits of exposure. The following steps will minimize risk of exposure.

- Establish a designated area for use. Mark the area with a DANGER, “name of specific agent”, and AUTHORIZED PERSONNEL ONLY.
- Use a containment device such as fume hoods when possible.
- Establish procedures for safe removal and disposal of contaminated waste in consultation with laboratory supervisors.
- Establish decontamination procedures in the case of accidental exposure.
- Provide training to ensure the safe handling, proper PPE, and storage of these substances is required for those who use these materials. The professor using the chemical is responsible for training which must be done prior to the use of any of these materials.

- Minimize the quantities of these chemicals used and stored in the laboratory including solution or mixtures.
- Chemicals with these properties will not be used unless no suitable alternative is available.
- Work with genotoxins, reproductive toxins and acutely toxic chemicals in a certified functioning fume hood or other system designed to minimize exposure to these substances. In all cases, work with these types of chemicals must be done in such a manner that the OSHA permissible exposure limits or similar standards are not exceeded.

Controlling Potential Exposure to Hazardous Chemicals

At the request of administration or faculty, exposure evaluations may be conducted by personal monitoring for any suspected overexposure to substances regulated by OSHA. Records of exposure evaluations will be kept by Gardner-Webb University Administration and provided to the department and affected employees and students as needed.

Inhalation Hazards

Inhalation is the most common route of entry a chemical can take to enter the body.

- Substitute a less volatile or a less toxic chemical, or substitute a liquid or solid chemical for a gaseous one whenever possible.
- Use well-functioning local exhaust ventilation systems.
- Dilution ventilation may be used to reduce exposure to nonhazardous nuisance odors.
- Gardner-Webb University Department of Natural Science does not use chemicals that require the use of respirators. In the event that respirator protection is required, professors must alert the Natural Sciences Department Chair who will implement a respirator program.

Skin/Eye Contact Hazards (Absorption)

- Wear personal protective equipment such as eye protection, face shields, gloves, appropriate shoes, lab aprons, lab coats, and other protective equipment as appropriate to the hazard. Because the chemical resistivity of the different types of protective equipment varies significantly, the lab supervisor should consult references to ascertain that the protective equipment material is resistant to the chemical being protected against.
- Safety showers/eye wash equipment are required where corrosive chemicals are used.

Ingestion Hazards

- Food and drink are not allowed in laboratories.
- Everyone is encouraged to wash their hands frequently while in the lab and on exiting the lab.
- Mouth pipetting is prohibited.
- Wear gloves as needed.

Injection Hazards

Injection can occur when lab personnel encounter sharp objects such as needles or broken glass. These objects can puncture the skin and bring contamination directly in contact with the bloodstream.

- Use care with all sharp objects.
- Use personal protective equipment and common sense to prevent exposure.
- Place all contaminated/discarded sharp objects in a properly labeled, puncture-proof container with a locking lid for disposal.

Personal Safety

Lab emergencies can be ranked by the following descriptions:

Major hazard emergency: the emergency is immediately dangerous to life and health, involves major injury to person(s), involves an area of an entire laboratory or more, involves an infectious agent, is a threat to the public, or involves a highly toxic, corrosive, or reactive material. Note: All eye injuries are considered Major Emergencies.

Minor hazard emergency: the emergency is small, is not a fire hazard, involves small amounts of hazardous material, or involves injury treatable with a first aid kit, such as a small cut or minor burn.

Unknown: If the nature of the hazard cannot be determined, use the High hazard emergency procedures.

Major Hazard Emergency

- Call 911 by dialing 9-911. Then contact University Police at x4444.
- Primary concern must be attention to any injured persons.
- If chemicals have contaminated large areas of the body, quickly remove contaminated clothing while using the safety shower. Remove any jewelry to facilitate removal of any residual contamination.
- Flush area with water for at least 15 minutes.
- If eyes have been affected, rinse with water.
- If chemicals have been ingested identify the chemical ingested and wrap the injured person in a blanket to prevent shock.
- If chemicals have been inhaled, evacuate the area and move the victim into fresh air.
- Be prepared to provide the following information to emergency medical personnel: Symptoms, identity of any chemical the victim might have been exposed to, time of incident, name of victim, etc…
- Protect yourself from exposure by using gloves and safety glasses.

Minor Hazard Emergency

- Ask victim if they want medical attention. If so, contact University Police at x4444.
- For small injuries, rinse the area thoroughly and treat with First Aid Kit.

Fire Emergency

- If any physical part of the building is burning (benches, floor, chairs, instrument) pull the fire alarm and evacuate the building immediately.
- Move injured ONLY in the event of immediate danger.
- Small flash fires can be dealt with using a fire extinguisher.

Chemical Spills

- Release/spill of multiple containers of multiple chemicals constitutes a Major Hazard Emergency. Evacuate the building immediately and call University Police at x4444.
- Do not attempt to clean the spill. Clean up of a Major Hazard must be done by a licensed waste contractor. University Police along with the Director of Environmental and Occupational Safety will make arrangements for clean up.
- Spills involving chemicals with properties that are known to offer no significant hazards to employees may be cleaned up by department personnel. Release/spill of one container of a nonhazardous chemical can be clean up by faculty/staff.
- Some chemicals may be sufficiently hazardous that small releases may require evacuation and clean up by a licensed contractor. See Standard Operating Procedure for Spill Management.
- All clean up must be done in accordance with MSDS guidance and in compliance with hazardous waste procedures. Spill clean up kits are available in each lab to facilitate clean up of minor spills.

Reporting

- For any type of incident, complete an Incident Report within 2 days of the emergency, both major and minor.
- Copies of the report are kept by the Department of Natural Sciences and the Director of Environmental and Occupational Safety.

First Aid Kits

- Maintain first aid kits in easily accessible and easily visible locations.
- Lab supervisors ensure that kits are properly stocked.
- Label location of First Aid kits.

Laboratory Incident Report Form

Date:

Name of Injured Person:
Student/Faculty/Staff/Other

Date of Incident:

Location of Incident:

Chemicals Involved, if any:

Type and location of injury:

Brief Description:

Action Taken:
Major Incidents are referred to 9-911 immediately.

Signature of Injured	Date

Signature of Lab Supervisor	Date

Signature of University Police Representative (if notified)	Date

Fume Hoods & Other Engineering Controls

Fume Hood Face Velocities

In a laboratory fume hood, the control of contaminants is achieved by drawing air through the face (sash) opening. The face velocity is defined as the average velocity of the air in this opening and is expressed in units of feet per minute. The Occupational Safety and Health Administration (OSHA) in its laboratory standard does not specify a required fume hood face velocity. As a result, hood users must look to published guidelines for recommendations on proper face velocities. The most authoritative of these published guidelines is the ANSI/AIHA Z9.5 American National Standard for Laboratory Ventilation. This publication recommends using an average face velocity of between 80 and 120 feet per minute. This face velocity applies with the sash at a "working height" (approximately 12 inches).

When using a fume hood, remember that the hood does not provide absolute containment or absolute protection from the materials in the hood. However, for most exposures, a properly designed hood in a properly designed room can provide adequate protection if certain work practices are followed. The work practices listed below are recommended by the American Conference of Governmental Industrial Hygienists in their text: "Industrial Ventilation: A Manual of Recommended Practices."

Withrow Hall contains only one fume hood. This hood is not explosion proof, and cannot be used for flammable materials.

A chemical fume hood cannot provide complete safety against all events which may occur in the hood, especially for toxic airborne contaminants with an exposure limit in the low part per billion range. For ordinary exposures, however, a properly designed hood in a properly ventilated room can provide adequate protection. Nevertheless, certain work practices are necessary for the hood to perform efficiently. The following work practices are required; more stringent practices may be necessary in some circumstances.

- Conduct all operations that may generate air contaminants at levels above the exposure limit inside a hood.
- As a general rule, do not operate fume hoods with the sash fully open and keep the sash closed when not being used.
- Mark the fume hood with a sticker showing face velocity at a height designated with an arrow.
- Keep all apparatus at least 6 inches back from the face of the hood. A stripe on the bench surface is a good reminder.
- Do not put your head in the hood when contaminants are being generated.

- Fume hoods with face velocities below 80 feet per minute or above 120 linear feet per minute must be marked with a sign indicating that the hood may not be used for chemical manipulations.

- Do not use the hood as a waste disposal mechanism or as a storage area.
- Be sure that the switch is in the “on” position whenever the hood is in use and test the hood often for air flow.
- Using hazardous solids (powders) in a hood may not be appropriate.
- Keep the slots in the hood baffle free of obstruction by apparatus or containers.
- Minimize foot traffic past the face of the hood.
- Keep laboratory doors and windows closed (exception: some laboratories are designed for the lab doors to be open).
- Do not remove hood sash or panels except when necessary for apparatus set-up; replace sash or panels before operating.
- Do not place electrical receptacles or other spark sources inside the hood when flammable liquids or gases are present.
- Use an appropriate barricade if there is a chance of explosion or eruption.
- If the hood sash is supposed to be partially closed for operation, the hood should be so labeled and the appropriate closure point clearly indicated.
- All fume hoods should have spill protection lips (at the front of hood and for cup sinks located in the hood).

Biological Safety

Only BSL1Level Hazards are used in teaching labs in the Department of Natural Sciences. BSL1 is described by NIH Guidelines for Research Involving rDNA Molecules. BSL1 represents work with well-characterized agents not known to consistently cause disease in health adult humans and of minimal potential hazard to laboratory personnel and the environment. The professor managing the lab or research is primarily responsible for ensuring that the microbiological agents used conform to the BSL1 designation. The professor is also responsible for training and disposal of biological material.

General Guidelines

- Access to the laboratory may be restricted at the discretion of the professor.
- Biological materials that need to be autoclaved are done so under the supervision of the professor/laboratory supervisor or are tagged as Bio Hazard Material and removed by a qualified vendor.
- Students, faculty, and staff exposed to biological hazards must be trained in proper techniques.
- The professor designates personal protective equipment. However, gloves and eye protection are recommended.
- Wipe working areas frequently with a disinfectant.
- Keep nonessential items away from working areas.
- All contaminated waste must be handled and stored properly to prevent exposure.
- Do not mouth pipet.
- Avoid touching face or mouth without washing hands.
- Food and drink are not allowed in microbiology labs.
- Wash hands frequently when using biological materials and wash hands at the end of procedures.
- Aerosols are the primary means of spreading infectious material for inhalation. Procedures that produce aerosols include centrifuging, heating inoculations loops, blowing out the last drop in a pipet, and changing animal bedding. Conduct procedures carefully to avoid these hazards.
- Exercise extreme caution when using needles, razor blades, and glass pipettes.
- Restrict needle use.
- Do not break, bend used needles. Do not attempt to recap used needles.
- Place all contaminated/discarded sharp objects in a properly labeled, puncture-proof container with a locking lid for disposal.

Training & Information

All faculty, staff, and students working in laboratories who may be exposed to hazardous chemicals must be apprised of the hazards of chemicals present in their work area. THIS INFORMATION AND TRAINING AS OUTLINED BELOW MUST BE PROVIDED BEFORE INITIAL ASSIGNMENT AND BEFORE NEW EXPOSURE SITUATIONS. Equipment necessary for the safe handling of hazardous substances must also be provided. Also, special hazardous materials training is mandatory for anyone who will be generating or handling hazardous waste.

The faculty of the Department of Natural Sciences who have advanced degrees in science (chemistry, biology, physics, engineering, etc…) are considered experts in their respective fields and are responsible for identifying potential chemical hazards in the areas in which they teach or conduct research. They are also responsible for providing training and documenting that training for students and others working in their laboratories.

Laboratory workers must be informed of the location and availability of the following:

- "Occupational Exposures to Hazardous Chemicals in Laboratories" (the OSHA Lab Standard - See Appendix I)
- This Chemical Hygiene Plan
- Reference materials on chemical safety (including material safety data sheets)
- Permissible exposure limits for OSHA regulated substances, or if there is no applicable OSHA standard, the recommended exposure limits or threshold limit value may be provided by the manufacturer.
- Signs and symptoms associated with exposure to the hazardous chemicals found in the lab.

Laboratory training must include:

- Detection methods that may be used to detect the presence or release of a hazardous chemical. Examples of detection methods include visual appearance, odor, detector papers, and an understanding of chemical monitoring devices.
- Physical and health hazards of the chemicals.
- Hazardous waste training.
- The work practices, personal protective equipment, and emergency procedures to be used to ensure that the employee may protect himself/herself from overexposure to hazardous chemicals.
- Medical consultations and examinations.
- Use of MSDS to determine the nature of chemical hazards.

Medical Consultation

An opportunity for laboratory workers to receive medical consultation must be provided under the following circumstances:

if an employee develops any symptoms thought to arise from chemical overexposure;
after an event such as a major spill, leak or explosion which may have resulted in an overexposure; or
an overexposure is identified as the result of an evaluation by the Chemical Hygiene Officer/Committee.

These suspected or actual exposures requiring medical evaluation can and should be treated as a regular Workers Compensation claim. The injured employee must fill out an Accident - Occupational Injury/Illness Report Form and go to an appropriate medical facility, e.g. occupational medicine clinic, employee health, qualified outside physician, etc., for treatment. Following notification of overexposure, arrangements for an appropriate medical examination must be completed before the exposed individual may return to work.

Any medical examination required by this Plan must be provided without cost to the employee, without loss of pay and at a reasonable time and place. Records of any medical examination will be maintained at the medical facility providing service or with appropriate medical personnel.

Planning for Emergencies

Planning and practicing for emergencies is an essential component of laboratory safety. Workers in labs should have the knowledge necessary to assess their risks from a small spill or release of a chemical or a small trash can fire, if they have received proper training. The most important aspect of this training is being able to differentiate between an incidental situation and an emergency. Practice in emergency procedures and evacuation drills will provide lab workers with the insight they need to make this differentiation.

An incidental release is one that does not cause an imminent health or safety hazard to laboratory workers and does not have to be cleaned up immediately in order to prevent death or serious injury to employees. Laboratory workers should prepare for and handle their own incidental spills or releases.

The following is a list of life threatening situations. If any of these situations occur, the emergency procedures of the following section need to be followed.

- Release of high concentrations of toxic substances
- Situation that is life or injury threatening
- Environments that are Immediately Dangerous to Life and Health (IDLH)
- Situation that presents an oxygen deficient atmosphere
- Condition that poses a fire or explosion hazard
- A situation that requires immediate attention because of the danger posed to employees in the area

Fires and Other Life Threatening Situation

The four actions below must be taken by whomever discovers a fire that cannot be put out safely by someone who knows how to use a fire extinguisher, or other life-threatening situation. Actual emergency conditions may require the procedures to be followed in a different order, depending on the layout of the laboratory, time of day, the number of people present and the location of the emergency relative to doors and alarm stations or telephones.

- Alert personnel in the immediate vicinity.
  Tell the nature and extent of the emergency.
  Give instructions to sound the alarm, close doors, call for assistance.

- Confine the fire or emergency without endangering yourself.
  Shut hood sash if possible.
  Close doors to prevent spread of vapors, gases or fire.
- Evacuate the building or hazardous area.
  Use the evacuation alarm system.
  Follow posted evacuation procedures.
  Assemble at a designated meeting point.
  Evacuation and assembly should be practiced in drills.
- Summon aid from a safe location.
  Call 911.
  Give location and type of emergency.

B. Clothing Fire and Severe Thermal Burns

Thermal burns from a clothing fire or a large splash of hot material can be life-threatening if they are deep, extensive or located on critical areas of the body. Severe burns of the hands, feet, face and genital areas are considered critical.

- To extinguish a clothing fire:
- Stop the person on fire from running! Do not allow anyone to run, not even to a fire blanket.
- Drop the person to the floor. Standing will allow flames to spread upward to eyes and nose.
- Roll the person to snuff out the flames.
- Cool the person. Remove smoldering clothing. Use cold water to cool burns and minimize injury (if the burning is not caused by a water-reactive chemical).
- Get medical assistance immediately.

C. Chemical Splash to the Eyes or Skin

The most important emergency measure if chemicals are splashed to the eyes or skin is immediate flushing with water in the emergency eyewash and/or shower. Most splashes need at least 15 minutes of washing. Get medical assistance immediately after flushing.

Appendix A: OSHA Laboratory Standard

Occupational exposure to hazardous chemicals in laboratories. - 1910.1450

- **Part Number:** 1910
- **Part Title:** Occupational Safety and Health Standards
- **Subpart:** Z
- **Subpart Title:** Toxic and Hazardous Substances
- **Standard Number:** 1910.1450
- **Title:** Occupational exposure to hazardous chemicals in laboratories.

1910.1450(a)

Scope and application.

1910.1450(a)(1)

This section shall apply to all employers engaged in the laboratory use of hazardous chemicals as defined below.

1910.1450(a)(2)

Where this section applies, it shall supersede, for laboratories, the requirements of all other OSHA health standards in 29 CFR part 1910, subpart Z, except as follows:

1910.1450(a)(2)(i)

For any OSHA health standard, only the requirement to limit employee exposure to the specific permissible exposure limit shall apply for laboratories, unless that particular standard states otherwise or unless the conditions of paragraph (a)(2)(iii) of this section apply.

1910.1450(a)(2)(ii)

Prohibition of eye and skin contact where specified by any OSHA health standard shall be observed.

1910.1450(a)(2)(iii)

Where the action level (or in the absence of an action level, the permissible exposure limit) is routinely exceeded for an OSHA regulated substance with exposure monitoring and medical surveillance requirements paragraphs (d) and (g)(1)(ii) of this section shall apply.

1910.1450(a)(3)

This section shall not apply to:

..1910.1450(a)(3)(i)

1910.1450(a)(3)(i)

Uses of hazardous chemicals which do not meet the definition of laboratory use, and in such cases, the employer shall comply with the relevant standard in 29 CFR part 1910, subpart Z, even if such use occurs in a laboratory.

1910.1450(a)(3)(ii)

Laboratory uses of hazardous chemicals which provide no potential for employee exposure. Examples of such conditions might include:

1910.1450(a)(3)(ii)(A)

Procedures using chemically-impregnated test media such as Dip-and-Read tests where a reagent strip is dipped into the specimen to be tested and the results are interpreted by comparing the color reaction to a color chart supplied by the manufacturer of the test strip; and

1910.1450(a)(3)(ii)(B)

Commercially prepared kits such as those used in performing pregnancy tests in which all of the reagents needed to conduct the test are contained in the kit.

1910.1450(b)

Definitions --

Action level means a concentration designated in 29 CFR part 1910 for a specific substance, calculated as an eight (8)-hour time-weighted average, which initiates certain required activities such as exposure monitoring and medical surveillance.

Assistant Secretary means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

Carcinogen (***see select carcinogen***).

Chemical Hygiene Officer means an employee who is designated by the employer, and who is qualified by training or experience, to provide technical guidance in the development and implementation of the provisions of the Chemical Hygiene Plan. This definition is not intended to place limitations on the position description or job classification that the designated individual shall hold within the employer's organizational structure.

Chemical Hygiene Plan means a written program developed and implemented by the employer which sets forth procedures, equipment, personal protective equipment and work practices that (i) are capable of protecting employees from the health hazards presented by hazardous

chemicals used in that particular workplace and (ii) meets the requirements of paragraph (e) of this section.

Combustible liquid means any liquid having a flashpoint at or above 100 deg. F (37.8 deg. C), but below 200 deg. F (93.3 deg. C), except any mixture having components with flashpoints of 200 deg. F (93.3 deg. C), or higher, the total volume of which make up 99 percent or more of the total volume of the mixture.

Compressed gas means:

(i) A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi at 70 deg. F (21.1 deg. C); or

(ii) A gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130 deg. F (54.4 deg C) regardless of the pressure at 70 deg. F (21.1 deg. C); or

(iii) A liquid having a vapor pressure exceeding 40 psi at 100 deg. F (37.8 C) as determined by ASTM D-323-72.

Designated area means an area which may be used for work with "select carcinogens," reproductive toxins or substances which have a high degree of acute toxicity. A designated area may be the entire laboratory, an area of a laboratory or a device such as a laboratory hood.

Emergency means any occurrence such as, but not limited to, equipment failure, rupture of containers or failure of control equipment which results in an uncontrolled release of a hazardous chemical into the workplace.

Employee means an individual employed in a laboratory workplace who may be exposed to hazardous chemicals in the course of his or her assignments.

Explosive means a chemical that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.

Flammable means a chemical that falls into one of the following categories:

(i) ***Aerosol, flammable*** means an aerosol that, when tested by the method described in 16 CFR 1500.45, yields a flame protection exceeding 18 inches at full valve opening, or a flashback (a flame extending back to the valve) at any degree of valve opening;

(ii) ***Gas, flammable*** means:

(A) A gas that, at ambient temperature and pressure, forms a flammable mixture with air at a concentration of 13 percent by volume or less; or

(B) A gas that, at ambient temperature and pressure, forms a range of flammable mixtures with air wider than 12 percent by volume, regardless of the lower limit.

(iii) ***Liquid, flammable*** means any liquid having a flashpoint below 100 deg F (37.8 deg. C), except any mixture having components with flashpoints of 100

deg. C) or higher, the total of which make up 99 percent or more of the total volume of the mixture.

(iv) ***Solid, flammable*** means a solid, other than a blasting agent or explosive as defined in § 1910.109(a), that is liable to cause fire through friction, absorption of moisture, spontaneous chemical change, or retained heat from manufacturing or processing, or which can be ignited readily and when ignited burns so vigorously and persistently as to create a serious hazard. A chemical shall be considered to be a flammable solid if, when tested by the method described in 16 CFR 1500.44, it ignites and burns with a self-sustained flame at a rate greater than one-tenth of an inch per second along its major axis.

Flashpoint means the minimum temperature at which a liquid gives off a vapor in sufficient concentration to ignite when tested as follows:

(i) Tagliabue Closed Tester (See American National Standard Method of Test for Flash Point by Tag Closed Tester, Z11.24 - 1979 (ASTM D 56-79)) - for liquids with a viscosity of less than 45 Saybolt Universal Seconds (SUS) at 100 deg. F (37.8 deg. C), that do not contain suspended solids and do not have a tendency to form a surface film under test; or

(ii) Pensky-Martens Closed Tester (See American National Standard Method of Test for Flashpoint by Pensky-Martens Closed Tester, Z11.7 - 1979 (ASTM D 93-79)) - for liquids with a viscosity equal to or greater than 45 SUS at 100 deg. F (37.8 deg. C), or that contain suspended solids, or that have a tendency to form a surface film under test; or

(iii) Setaflash Closed Tester (see American National Standard Method of test for Flash Point by Setaflash Closed Tester (ASTM D 3278-78)).

Organic peroxides, which undergo autoaccelerating thermal decomposition, are excluded from any of the flashpoint determination methods specified above.

Hazardous chemical means a chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. The term "health hazard" includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic systems, and agents which damage the lungs, skin, eyes, or mucous membranes.

Appendices A and B of the Hazard Communication Standard (29 CFR 1910.1200) provide further guidance in defining the scope of health hazards and determining whether or not a chemical is to be considered hazardous for purposes of this standard.

Laboratory means a facility where the "laboratory use of hazardous chemicals" occurs. It is a workplace where relatively small quantities of hazardous chemicals are used on a non-production basis.

Laboratory scale means work with substances in which the containers used for reactions, transfers, and other handling of substances are designed to be easily and safety manipulated by one person. "Laboratory scale" excludes

those workplaces whose function is to produce commercial quantities of materials.

Laboratory-type hood means a device located in a laboratory, enclosure on five sides with a movable sash or fixed partial enclosed on the remaining side; constructed and maintained to draw air from the laboratory and to prevent or minimize the escape of air contaminants into the laboratory; and allows chemical manipulations to be conducted in the enclosure without insertion of any portion of the employee's body other than hands and arms.

Walk-in hoods with adjustable sashes meet the above definition provided that the sashes are adjusted during use so that the airflow and the exhaust of air contaminants are not compromised and employees do not work inside the enclosure during the release of airborne hazardous chemicals.

Laboratory use of hazardous chemicals means handling or use of such chemicals in which all of the following conditions are met:

(i) Chemical manipulations are carried out on a "laboratory scale;"

(ii) Multiple chemical procedures or chemicals are used;

(iii) The procedures involved are not part of a production process, nor in any way simulate a production process; and

(iv) "Protective laboratory practices and equipment" are available and in common use to minimize the potential for employee exposure to hazardous chemicals.

Medical consultation means a consultation which takes place between an employee and a licensed physician for the purpose of determining what medical examinations or procedures, if any, are appropriate in cases where a significant exposure to a hazardous chemical may have taken place.

Organic peroxide means an organic compound that contains the bivalent -O-O- structure and which may be considered to be a structural derivative of hydrogen peroxide where one or both of the hydrogen atoms has been replaced by an organic radical.

Oxidizer means a chemical other than a blasting agent or explosive as defined in § 1910.109(a), that initiates or promotes combustion in other materials, thereby causing fire either of itself or through the release of oxygen or other gases.

Physical hazard means a chemical for which there is scientifically valid evidence tat it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer pyrophoric, unstable (reactive) or water-reactive.

Protective laboratory practices and equipment means those laboratory procedures, practices and equipment accepted by laboratory health and safety experts as effective, or that the employer can show to be effective, in minimizing the potential for employee exposure to hazardous chemicals.

Reproductive toxins means chemicals which affect the reproductive

chemicals which affect the reproductive capabilities including chromosomal damage (mutations) and effects on fetuses (teratogenesis).

Select carcinogen means any substance which meets one of the following criteria:

(i) It is regulated by OSHA as a carcinogen; or

(ii) It is listed under the category, "known to be carcinogens," in the Annual Report on Carcinogens published by the National Toxicology Program (NTP)(latest edition); or

(iii) It is listed under Group 1 ("carcinogenic to humans") by the International Agency for research on Cancer Monographs (IARC)(latest editions); or

(iv) It is listed in either Group 2A or 2B by IARC or under the category, "reasonably anticipated to be carcinogens" by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:

(A) After inhalation exposure of 6-7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m(3);

(B) After repeated skin application of less than 300 (mg/kg of body weight) per week; or

(C) After oral dosages of less than 50 mg/kg of body weight per day.

Unstable (reactive) means a chemical which is the pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shocks, pressure or temperature.

Water-reactive means a chemical that reacts with water to release a gas that is either flammable or presents a health hazard.

1910.1450(c)

Permissible exposure limits. For laboratory uses of OSHA regulated substances, the employer shall assure that laboratory employees' exposures to such substances do not exceed the permissible exposure limits specified in 29 CFR part 1910, subpart Z.

..1910.1450(d)

1910.1450(d)

Employee exposure determination --

1910.1450(d)(1)

Initial monitoring. The employer shall measure the employee's exposure to any substance regulated by a standard which requires monitoring if there is reason to believe that exposure levels for that substance routinely exceed the

action level (or in the absence of an action level, the PEL).

1910.1450(d)(2)

Periodic monitoring. If the initial monitoring prescribed by paragraph (d)(1) of this section discloses employee exposure over the action level (or in the absence of an action level, the PEL), the employer shall immediately comply with the exposure monitoring provisions of the relevant standard.

1910.1450(d)(3)

Termination of monitoring. Monitoring may be terminated in accordance with the relevant standard.

1910.1450(d)(4)

Employee notification of monitoring results. The employer shall, within 15 working days after the receipt of any monitoring results, notify the employee of these results in writing either individually or by posting results in an appropriate location that is accessible to employees.

1910.1450(e)

Chemical hygiene plan -- General. (Appendix A of this section is non-mandatory but provides guidance to assist employers in the development of the Chemical Hygiene Plan).

1910.1450(e)(1)

Where hazardous chemicals as defined by this standard are used in the workplace, the employer shall develop and carry out the provisions of a written Chemical Hygiene Plan which is:

1910.1450(e)(1)(i)

Capable of protecting employees from health hazards associated with hazardous chemicals in that laboratory and

1910.1450(e)(1)(ii)

Capable of keeping exposures below the limits specified in paragraph (c) of this section.

1910.1450(e)(2)

The Chemical Hygiene Plan shall be readily available to employees, employee representatives and, upon request, to the Assistant Secretary.

1910.1450(e)(3)

The Chemical Hygiene Plan shall include each of the following elements and shall indicate specific measures that the employer will take to ensure

laboratory employee protection;

1910.1450(e)(3)(i)

Standard operating procedures relevant to safety and health considerations to be followed when laboratory work involves the use of hazardous chemicals;

1910.1450(e)(3)(ii)

Criteria that the employer will use to determine and implement control measures to reduce employee exposure to hazardous chemicals including engineering controls, the use of personal protective equipment and hygiene practices; particular attention shall be given to the selection of control measures for chemicals that are known to be extremely hazardous;

1910.1450(e)(3)(iii)

A requirement that fume hoods and other protective equipment are functioning properly and specific measures that shall be taken to ensure proper and adequate performance of such equipment;

..1910.1450(e)(3)(iv)

1910.1450(e)(3)(iv)

Provisions for employee information and training as prescribed in paragraph (f) of this section;

1910.1450(e)(3)(v)

The circumstances under which a particular laboratory operation, procedure or activity shall require prior approval from the employer or the employer's designee before implementation;

1910.1450(e)(3)(vi)

Provisions for medical consultation and medical examinations in accordance with paragraph (g) of this section;

1910.1450(e)(3)(vii)

Designation of personnel responsible for implementation of the Chemical Hygiene Plan including the assignment of a Chemical Hygiene Officer, and, if appropriate, establishment of a Chemical Hygiene Committee; and

1910.1450(e)(3)(viii)

Provisions for additional employee protection for work with particularly hazardous substances. These include "select carcinogens," reproductive toxins and substances which have a high degree of acute toxicity. Specific consideration shall be given to the following provisions which shall be included where appropriate:

1910.1450(e)(3)(viii)(A)

Establishment of a designated area;

1910.1450(e)(3)(viii)(B)

Use of containment devices such as fume hoods or glove boxes;

1910.1450(e)(3)(viii)(C)

Procedures for safe removal of contaminated waste; and

1910.1450(e)(3)(viii)(D)

Decontamination procedures.

1910.1450(e)(4)

The employer shall review and evaluate the effectiveness of the Chemical Hygiene Plan at least annually and update it as necessary.

1910.1450(f)

Employee information and training.

1910.1450(f)(1)

The employer shall provide employees with information and training to ensure that they are apprised of the hazards of chemicals present in their work area.

1910.1450(f)(2)

Such information shall be provided at the time of an employee's initial assignment to a work area where hazardous chemicals are present and prior to assignments involving new exposure situations. The frequency of refresher information and training shall be determined by the employer.

1910.1450(f)(3)

Information. Employees shall be informed of:

1910.1450(f)(3)(i)

The contents of this standard and its appendices which shall be made available to employees;

1910.1450(f)(3)(ii)

the location and availability of the employer's Chemical Hygiene Plan;

..1910.1450(f)(3)(iii)

1910.1450(f)(3)(iii)

The permissible exposure limits for OSHA regulated substances or recommended exposure limits for other hazardous chemicals where there is no applicable OSHA standard;

1910.1450(f)(3)(iv)

Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory; and

1910.1450(f)(3)(v)

The location and availability of known reference material on the hazards, safe handling, storage and disposal of hazardous chemicals found in the laboratory including, but not limited to, Material Safety Data Sheets received from the chemical supplier.

1910.1450(f)(4)

Training.

1910.1450(f)(4)(i)

Employee training shall include:

1910.1450(f)(4)(i)(A)

Methods and observations that may be used to detect the presence or release of a hazardous chemical (such as monitoring conducted by the employer, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released, etc.);

1910.1450(f)(4)(i)(B)

The physical and health hazards of chemicals in the work area; and

1910.1450(f)(4)(i)(C)

The measures employees can take to protect themselves from these hazards, including specific procedures the employer has implemented to protect employees from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used.

1910.1450(f)(4)(ii)

The employee shall be trained on the applicable details of the employer's written Chemical Hygiene Plan.

1910.1450(g)

Medical consultation and medical examinations.

1910.1450(g)(1)

The employer shall provide all employees who work with hazardous chemicals an opportunity to receive medical attention, including any follow-up examinations which the examining physician determines to be necessary, under the following circumstances:

1910.1450(g)(1)(i)

Whenever an employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory, the employee shall be provided an opportunity to receive an appropriate medical examination.

1910.1450(g)(1)(ii)

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.

1910.1450(g)(1)(iii)

Whenever 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, the affected employee shall be provided an opportunity for a medical consultation. Such consultation shall be for the purpose of determining the need for a medical examination.

..1910.1450(g)(2)

1910.1450(g)(2)

All medical examinations and consultations shall be performed by or under the direct supervision of a licensed physician and shall be provided without cost to the employee, without loss of pay and at a reasonable time and place.

1910.1450(g)(3)

Information provided to the physician. The employer shall provide the following information to the physician:

1910.1450(g)(3)(i)

The identity of the hazardous chemical(s) to which the employee may have been exposed;

1910.1450(g)(3)(ii)

A description of the conditions under which the exposure occurred including quantitative exposure data, if available; and

1910.1450(g)(3)(iii)

A description of the signs and symptoms of exposure that the employee is experiencing, if any.

1910.1450(g)(4)

Physician's written opinion.

1910.1450(g)(4)(i)

For examination or consultation required under this standard, the employer shall obtain a written opinion from the examining physician which shall include the following:

1910.1450(g)(4)(i)(A)

Any recommendation for further medical follow-up;

1910.1450(g)(4)(i)(B)

The results of the medical examination and any associated tests;

1910.1450(g)(4)(i)(C)

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; and

1910.1450(g)(4)(i)(D)

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.

1910.1450(g)(4)(ii)

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

1910.1450(h)

Hazard identification.

1910.1450(h)(1)

With respect to labels and material safety data sheets:

1910.1450(h)(1)(i)

Employers shall ensure that labels on incoming containers of hazardous chemicals are not removed or defaced.

1910.1450(h)(1)(ii)

Employers shall maintain any material safety data sheets that are received with incoming shipments of hazardous chemicals, and ensure that they are readily accessible to laboratory employees.

1910.1450(h)(2)

The following provisions shall apply to chemical substances developed in the laboratory:

..1910.1450(h)(2)(i)

1910.1450(h)(2)(i)

If the composition of the chemical substance which is produced exclusively for the laboratory's use is known, the employer shall determine if it is a hazardous chemical as defined in paragraph (b) of this section. If the chemical is determined to be hazardous, the employer shall provide appropriate training as required under paragraph (f) of this section.

1910.1450(h)(2)(ii)

If the chemical produced is a byproduct whose composition is not known, the employer shall assume that the substance is hazardous and shall implement paragraph (e) of this section.

1910.1450(h)(2)(iii)

If the chemical substance is produced for another user outside of the laboratory, the employer shall comply with the Hazard Communication Standard (29 CFR 1910.1200) including the requirements for preparation of material safety data sheets and labeling.

1910.1450(i)

Use of respirators. Where the use of respirators is necessary to maintain exposure below permissible exposure limits, the employer shall provide, at no cost to the employee, the proper respiratory equipment. Respirators shall be selected and used in accordance with the requirements of 29 CFR 1910.134.

1910.1450(j)

Recordkeeping.

1910.1450(j)(1)

The employer shall establish and maintain for each employee an accurate record of any measurements taken to monitor employee exposures and any medical consultation and examinations including tests or written opinions required by this standard.

1910.1450(j)(2)

The employer shall assure that such records are kept, transferred, and made available in accordance with 29 CFR 1910.1020.

1910.1450(k)

Dates --

1910.1450(k)(1)

Effective date. This section shall become effective May 1, 1990.

1910.1450(k)(2)

Start-up dates.

1910.1450(k)(2)(i)

Employers shall have developed and implemented a written Chemical Hygiene Plan no later than January 31, 1991.

1910.1450(k)(2)(ii)

Paragraph (a)(2) of this section shall not take effect until the employer has developed and implemented a written Chemical Hygiene Plan.

1910.1450(l)

Appendices. The information contained in the appendices is not intended, by itself, to create any additional obligations not otherwise imposed or to detract from any existing obligation.

[55 FR 3327, Jan. 31, 1990; 55 FR 7967, March, 6, 1990; 55 FR 12777, March 30, 1990; 61 FR 5507, Feb. 13, 1996]

Appendix B

Acutely Toxic Chemicals

This list is provided as a guide and is not all inclusive. Review material safety data sheet.

Acrolein	Acrylyl chloride	2-Aminopyridine
Benzyl chloride	Bromine	Chlorine dioxide
Chlorine trifluoride	Chlorpicrin	Cyanogen chloride
Cyanuric fluoride	Decaborane	Dichloro acetylene
Dimethyl disulfide	Dimethylsulfate	Dimethylsulfide
Ethylene chlorohydrin	Ethylene fluorohydrin	Hexamethylene diisocyanate
Hexamethyl phosphoramide	Iodine	Iron pentacarbonyl
Isopropyl formate	Methacryloyl chloride	Methacryloxyethyl isocyanate
Methyl acrylonitrile	Methyl chloroformate	Methylene biphenyl isocyanate
Methyl fluoroacetate	Methyl fluorosulfate	Methyl hydrazine
Methyl Mercury (and other organicforms)	Methyltrichlorosilane	Methyl vinyl ketone
Nickel carbonyl	Nitrogen tetroxide	Nitrogen trioxide
Organo Tin compounds	Osmium tetroxide	Oxygen difluoride
Ozone	Pentaborane	Perchloromethyl mercaptan
Phosphorus oxychloride	Phosphous trichloride	Sarin
Sulfur monochloride	Sulfur pentafluoride	Sulfuryl chloride
Tellurium	Tetramethyl	Tetranitromethane

hexafluoride	succinonitrile	
Thionyl chloride	Toluene-2,4-diisocyanate	Trichloro (chlormethyl) silane

Appendix C

Suspected Carcinogens

This list is provided as a guide and is not all inclusive. Carefully review material safety data sheets before working with chemicals.

Chemical Name	CAS
A-alpha-C (2-Amino-9H-pyrido{2,3-b]indole)	26148685
Acetaldehyde	76070
Acetamide	60355
Acetochlor	34256821
2-Acetylaminofluorene	53963
Acifluorfen	62476599
Acrylamide	79061
Acrylonitrile	107131
Actinomycin D	50760
Adriamycin (Doxorubicin hydrochloride)	23214928
AF-2; [2-(2-furyl)-3-(5-nitro-2-furyl)]acrylamide	3588537
Aflatoxins	----
Alachlor	15972608
Aldrin	309002
Allyl chloride	107051
2-Aminoanthraquinone	117793
p-Aminoazobenzene	60093
ortho-Aminoazotoluene	97563
4-Aminobiphenyl (4-aminodiphenyl)	92671
3-Amino-9-ethylcarbazole	6109973

hydrochloride	
1-Amino-2-methylanthraquinone	82280
2-Amino-5-(5-nitro-2-furyl)-1,3,4-thiadiazole	712685
Amitrole	61825
Aniline	62533
ortho-Anisidine	90040
ortho-Anisidine hydrochloride	134292
Antimony oxide (Antimony trioxide)	130964
Aramite	140578
Arsenic (inorganic arsenic compounds)	---
Asbestos	1332214
Auramine	492808
Azaserine	115026
Azathioprine	446866
Azacitidine	320672
Azobenzene	103333
Benz[a]anthracene	56553
Benzene	71432
Benzidine [and its salts]	92875
Benzo [b] fluoranthene	205992
Benzo [j] fluoranthene	205823
Benzo [k] fluoranthene	207089
Benzofuran	271896
Benzo [a] pyrene	50328
Benzotrichloride	98077
Benzyl chloride	100447

Benzyl violet 4B	1694093
Beryllium and beryllium compounds	---
Betel quid with tobacco	---
Bis(2-chloroethyl)ether	111444
N,N,-Bis(2-chloroethyl)-2-naphthylamine (Chlornapazine)	494031
Bischloroethyl nitrosourea (BCNU) (Carmustine)	154938
Bis (chloromethyl) ether	542881
Bitumens, extracts of steam-refined and air-refined	---
Bracken fern	---
Bromodichloromethane	75274
Bromoform	75252
1,3-Butadiene	106990
1,4-Butanediol dimethanesulfonate (Busulfan)	55981
Butylated hydroxyanisole	25013165
vbeta-Butyrolactone	3068880
Cadmium and cadmium compounds	---
Captafol	2425061
Captan	133062
Carbon tetrachloride	56235
Carbon-black extracts	---
Ceramic fibers	---
Chlorambucil	305033
Chloramphenicol	56757
Chlordane	57749
Chlordecone (Kepone)	143500

Chlordimeform	115286
Chlorendic acid	115286
Chlorinated paraffins	108171262
Chlorodibromethane	124481
Chloroethane (Ethyl chloride)	75003
1-(2-Chloroethyl)-3-cyclohexyl-1-nitrosourea	13010474
1-(2-Chloroethyl)-3-(4-methylcyclohexyl)-1-nitrosourea (Methyl-CCNU)	13909096
Chloroform	67663
Chloromethyl methyl ether	107302
3-Chloro-2-methylpropene	563473
4-Chloro-ortho-phenylenediamine	95830
p-Chloro-o-toluidine	95692
Chlorothalonil	1897456
Chlorozotocin	54749905
Chromium (hexavalent)	---
Chrysene	18019
C. I. Acid Red 114	6459945
C. I. Basic Red 9 monohydrochloride	569619
Ciclosporin (Cyclosporin A; Cyclosporine)	59865133;79217600
Cinnamyl anthranilate	87296
Cisplatin	15663271
Citrus Red No. 2	6358538
Cobalt metal powder	7440484
Cobalt [II] oxide	1307966
Conjugated estrogens	---

Creosotes	---
para-Cresidine	120718
Cupferron	135206
Cycasin	14901087
Cyclophosphamide (anhydrous)	50180
Cyclophosphamide (hydrated)	6055192
D&C Orange No. 17	46831
D&C Red No. 8	2092560
D&C Red No. 9	5160021
D&C Red No. 19	81889
Dacarbazine	4342034
Daminozide	1596845
Dantron (Chrysazin; 1,8-Dihydroxyanthraquinone)	117102
Daunomycin	20830813
DDD (Dichlorodiphenyldichloroethane)	72548
DDE (Dichlorodiphenyldichloroethylene)	72559
DDT (Dichlorodiphenyltrichloroethane)	50293
DDVP (Dichlorvos)	62737
N,N'-Diacetylbenzidine	613354
2,4-Diaminoanisole	615054
2,4-Diaminoanisole sulfate	39156417
4,4'-Diaminodiphenyl ether (4,4'-Oxydianiline)	101804
2,4-Diaminotoluene	95807
Diaminotoluene (mixed)	---
Dibenz[a,h]acridine	226368

Dibenz[a,j]acridine	224420
Dibenz[a,h]anthracene	53703
7H-Dibenzo[c,g]carbazole	194592
Dibenzo[a,e]pyrene	192654
Dibenzo[a,h]pyrene	189640
Dibenzo[a,i]pyrene	189559
Dibenzo[a,l]pyrene	191300
1,2-Dibromo-3-chloropropane (DBCP)	96128
p-Dichlorobenzene	106467
3,3'-Dichlorobenzidine	91941
1,4-Dichloro-2-butene	764410
3,3'-Dichloro-4,4'-diaminodiphenyl ether	28434868
1,1-Dichloroethane	75343
Dichloromethane (Methylene chloride)	75092
1,2-Dichloropropane	78875
1,3-Dichloropropene	542756
Dieldrin	60571
Dienestrol	84173
Diepoxybutane	1464535
Diesel engine exhaust	---
Di(2-ethylhexyl)phthalate	117817
1,2-Diethylhydrazine	1615801
Diethyl sulfate	64675
Diethylstilbestrol	56531
Diglycidyl resorcinol ether (DGRE)	101906
Dihydrosafrole	94586
3,3'-Dimethoxybenzidine (ortho-	119904

Dianisidine)	
3,3'-Dimethoxybenzidine dihydrochloride (ortho-Dianisidine dihydrochloride)	20325400
Dimethylcarbamoyl chloride	79447
1,1-Dimethylhydrazine (UDMH)	57147
1,2-Dimethylhydrazine	540738
Dimethylvinylchloride	513371
1,6-Dinitropyrene	42397648
1,8-Dinitropyrene	42397659
2,4-Dinitrotoluene	121142
1,4-Dioxane	123911
Diphenylhydantoin (Phenytoin)	57410
Diphenylhydantoin (Phenytoin), sodium salt	630933
Direct Black 38 (technical grade)	1937377
Direct Blue 6 (technical grade)	2602462
Direct Brown 95 (technical grade)	16071866
Disperse Blue 1	2475458
Epichlorohydrin	106898
Erionite	12510428
Estradiol 17ß	50282
Estrone	53167
Ethinylestradiol	57636
Ethyl acrylate	140885
Ethyl methanesulfonate	62500
Ethyl-4-4'-dichlorobenzilate	510156
Ethylene dibromide	106934

Ethylene dichloride (1,2-Dichloroethane)	107062
Ethylene oxide	75218
Ethylene thiourea	96457
Ethyleneimine	151564
Folpet	133073
Formaldehyde	50000
2-(2-Formylhydrazino)-4-(5-nitro-2-furyl)thiazole	3570750
Furazolidone	67458
Furmecyclox	60568050
Glu-P-1 (2-Amino-6-methyldipyrido[1,2-a:3',2'- d]imidazole)	67730114
Glycidaldehyde	765344
Glycidol	556525
Griseofulvin	126078
Gyromitrin (Acetaldehyde methylformylhydrazone)	16568028
HC Blue 1	2784943
Heptachlor	76448
Heptachlor epoxide	1024573
Hexachlorobenzene	118741
Hexachlorocyclohexane (technical grade)	---
Hexachlorodibenzodioxin	34465468
Hexachloroethane	67721
Hexamethylphosphoramide	680319
Hydrazine	302012
Hydrazine sulfate	10034932

Hydrazobenzene (1,2-Diphenylhydrazine)	122667
Indeno [1,2,3-cd]pyrene	193395
IQ (2-Amino-3-methylimidazp[4,5-f]quinoline)	76180966
Iron dextran complex	9004664
Isosafrole	120581
Lactofen	77501634
Lasiocarpine	303344
Lead acetate	301042
Lead phosphate	7446277
Lead subacetate	1335326
Lindane	---
Mancozeb	8018017
Maneb	12427382
Me-A-alpha-C (2-Amino-3-methyl-9H-pyrido[2,3-b]indole)	68005837
Medroxyprogesterone acetate	71589
Melphalan	148823
Merphalan	531760
Mestranol	72333
8-Methoxypsoralen with ultraviolet A therapy	298817
5-Methoxypsoralen with ultraviolet A therapy	484208
2-Methylaziridine (Propyleneimine)	75558
Methylazoxymethanol	590965
Methylazoxymethanol acetate	592621
3-Methylcholanthrene	56495

5-Methylchrysene	3697243
4,4'-Methylene bis(2-chloroaniline)	101144
4,4'-Methylene bis(N,N-dimethyl)benzenamine	101611
4,4'-Methylene bis(2-methylaniline)	838880
4,4'-Methylenedianiline	01779
4,4'-Methylenedianiline dihydrochloride	13552448
Methylhydrazine and its salts	13552448
Methyl iodide	74884
Methyl methanesulfonate	66273
2-Methyl-1-nitroanthraquinone	129157
N-Methyl-N'-nitro-N-nitrosoguanidine	70257
N-Methylolacrylamide	924425
Methylthiouracil	56042
Metiram	9005422
Metronidazole	443481
Michler's ketone	90948
Mirex	2385855
Mitomycin C	50077
Monocrotaline	315220
5-(Morpholinomethyl)-3-[(5-nitro-furfurylidene)-amino]-2 -oxalolidinone	139913
Mustard Gas	505602
Nafenopin	3771195
1-Naphthylamine	124327
2-Naphthylamine	91598
Nickel and certain nickel compounds	---

Nickel carbonyl	13463393
Nickel subsulfide	12035722
Niridazole	61474
Nitrilotriacetric acid	139139
Nitrilotriacetric acid, trisodium salt monohydrate	18662538
5-Nitroacenaphthene	602879
5-Nitro-o-anisidine	99592
4-Nitrobiphenyl	93933
6-Nitrochrysene	7496028
Nitrofen (technical grade)	1836755
2-Nitrofluorene	607578
Nitrofurazone	59870
1-[5-Nitrofurfurylidene)-amino]-2-imidazolidinone	555840
N-[4-(5-Nitro-2-furyl)-2-thiazolyl]acetamide	531828
Nitrogen mustard (Mechlorethamine)	51752
Nitrogen mustard hydrochloride (Mechlorethamine hydrochloride)	55867
Nitrogen mustard N-oxide	126852
Nitrogen mustard N-oxide hydrochloride	302705
2-Nitropropane	79469
1-Nitropyrene	5522430
4-Nitropyrene	57835924
N-Nitrosodi-n-butylamine	924163
N-Nitrosodiethanolamine	1116547
N-Nitrosodiethylamine	55185

N-Nitrosodimethylamine	62759
p-Nitrosodiphenylamine	156105
N-Nitrosodiphenylamine	86306
N-Nitrosodi-n-propylamine	621647
N-Nitroso-N-ethylurea	759739
3-(N-Nitrosomethylamino)propionitrile	60153493
4-(N-Nitrosomethylamino)-1-(3-pyridyl)1-butanone	64091914
N-Nitrosomethylethylamine	10595956
N-Nitroso-N-methylurea	684935
N-Nitroso-N-methylurethane	615532
N-Nitrosomethylvinylamine	4549400
N-Nitrosomorpholine	59892
N-Nitrosonornicotine	16543558
N-Nitrosopiperidine	100754
N-Nitrosopyrrolidine	930552
N-Nitrososarcosine	13256229
Norethisterone (Norethindrone)	68224
Ochratoxin A	303479
Oxadiazon	19666309
Oxymetholone	434071
Panfuran S	---
Pentachlorophenol	87865
Phenacetin	62442
Phenazopyridine	94780
Phenazopyridine hydrochloride	136403
Phenesterin	3546109
Phenobarbital	50066

Phenoxybenzamine	59961
Phenoxybenzamine hydrochloride	63923
Phenyl glycidyl ether	22601
Phenylhydrazine and its salts	---
o-Phenylphenate, sodium	132274
Polybrominated biphenyls	---
Polychlorinated biphenyls	---
Polygeenan	53973981
Ponceau MX	3761533
Ponceau 3R	3564098
Potassium bromate	7758012
Procarbazine	671169
Procarbazine hydrochloride	366701
Progesterone	57830
1,3-Propane sultone	1120714
beta-Propiolactone	57578
Propylene oxide	75569
Propylthiouracil	51525
Reserpine	50555
Saccharin	81072
Saccharin, sodium	128449
Safrole	94597
Selenium sulfide	7446346
Silica, crystalline	---
Streptozotocin	18883664
Styrene oxide	96093
Sulfallate	95067

Talc´ containing asbestiform fibers	---
Testosterone and its esters	58220
2,3,7,8-Tetrachlorodibenzo-para-dioxin (TCDD)	1746016
1,1,2,2-Tetrachloroethane	79345
Tetrachloroethylene (Perchloroethylene)	127184
p-a, a, a-Tetrachlorotoluene	5216251
Tetranitromethane	509148
Thioacetamide	62555
4,4´ - Thiodianiline	139651
Thiourea	62566
Thorium dioxide	1314201
Toluene diisocyanate	26471625
ortho-Toluidine	95534
ortho-Toluidine hydrochloride	636215
para-Toluidine	106490
Toxaphene (Polychorinated camphenes)	8001352
Trasulfan	299752
Trichlormethine (Trimustine hydrochloride)	817094
2,4,6-Trichlorophenol	88062
Triphenyltin hydroxide	76879
Trichloroethylene	79016
Tris (aziridinyl)-para-benzoquinone (Triaziquone)	68768
Tris (1-aziridinyl) phosphine sulfide (Thiotepa)	52244
Tris (2-chloroethyl) phosphate	115968

Tris (2,3-dibromopropyl) phosphate	126727
Trp-P-1 (Tryptophan-P-1)	62450060
Trp-P-2 (Tryptophan-P-2)	62450071
Trypan blue (commercial grade)	72571
Uracil mustard	66751
Urethane (Ethyl carbamate)	51796
Vinyl bromide	593602
Vinyl chloride	75014
4-Vinyl-1-cyclohexene diepoxide (Vinyl cyclohexene dioxide)	106876
Vinyl trichloride (1,1,2-Trichloroethane)	79005
2,6-Xylidine (2,6-Dimethylaniline)	87627
Zineb	12122677

Appendix D

Reproductive Hazards

This list is provided as a guide and is not all inclusive. Review material safety data sheet.

Name	CAS#	Name	CAS#
Acetaldehyde	75-07-0	Hydrazine(s)	302-01-2
Arsenic	7440-38-2	Hexafluoroacetone	684-16-2
Aniline	62-53-3	Halothane	151-67-7
Aflatoxins		Karathane	131-72-6
Benzene	71-43-2	Lead (inorganic compounds)	7439-92-1
Benzo(a)pyrene	50-32-8	2-Methoxyethanol	109-86-4
Carbon disulfide	75-15-0	2-Methoxyethyl acetate	110-49-6
Chloroform	67-66-3	Methyl chloride	74-87-3
Chloroprene	126-99-8	N-Methyl-2-pyrrolidone	872-50-4
Dimethyl	68-12-	Propylene glycol	107-

formamide	2	monomethyl ether	98-2
Di-sec-octyl-phthalate	117-81-7	Propylene glycol monomethyl ether acetate	108-65-6
Dinitrooctyl phenol	63149-81-5	Propylene oxide	75-56-9
Dithane	111-54-6	Trichloroethylene	79-01-6
2-Ethoxy ethanol	110-80-5	RH-7592	
2-Ethoxyethyl acetate	111-15-9v	Systhane/RH-3866	88671-89-0
Ethylene thiourea	96-45-7	TOK (herbicide)	1836-75-5
2-Ethyhexanol	104-76-7	Toluene	108-88-3
Glycol ethers		Vinyl chloride	75-01-4

Appendix E
P-Listed Chemicals

Waste #	Chemical Abstracts #	Substance
P023	107–20–0	Acetaldehyde, chloro-
P002	591–08–2	Acetamide, N-(aminothioxomethyl)-
P057	640–19–7	Acetamide, 2-fluoro-
P058	62–74–8	Acetic acid, fluoro-, sodium salt
P002	591–08–2	1-Acetyl-2-thiourea
P003	107–02–8	Acrolein
P070	116–06–3	Aldicarb
P203	1646–88–4	Aldicarb sulfone.
P004	309–00–2	Aldrin
P005	107–18–6	Allyl alcohol
P006	20859–73–8	Aluminum phosphide (R,T)
P007	2763–96–4	5-(Aminomethyl)-3-isoxazolol
P008	504–24–5	4-Aminopyridine
P009	131–74–8	Ammonium picrate (R)
P119	7803–55–6	Ammonium vanadate
P099	506–61–6	Argentate(1-), bis(cyano-C)-, potassium
P010	7778–39–4	Arsenic acid H3AsO4
P012	1327–53–3	Arsenic oxide As2O3
P011	1303–28–2	Arsenic oxide As2O5
P011	1303–28–2	Arsenic pentoxide
P012	1327–53–3	Arsenic trioxide
P038	692–42–2	Arsine, diethyl-
P036	696–28–6	Arsonous dichloride, phenyl-
P054	151–56–4	Aziridine
P067	75–55–8	Aziridine, 2-methyl-
P013	542–62–1	Barium cyanide
P024	106–47–8	Benzenamine, 4-chloro-
P077	100–01–6	Benzenamine, 4-nitro-
P028	100–44–7	Benzene, (chloromethyl)-

P042	51–43–4	1,2-Benzenediol, 4-[1-hydroxy-2
		(methylamino)ethyl]-, (R)-
P046	122–09–8	Benzeneethanamine, alpha,alpha-dimethyl-
P014	108–98–5	Benzenethiol
P127	1563–66–2	7-Benzofuranol, 2,3-dihydro-2,2-dimethyl-,
		methylcarbamate.
P188	57–64–7	Benzoic acid, 2-hydroxy-, compd. With
		(3aS-cis)-1,2,3,3a,8,8a-hexahydro-1,3a,8-
		trimethylpyrrolo[2,3-b]indol-5-yl
		methylcarbamate ester (1:1).
P001	1 81–81–2	2H-1-Benzopyran-2-one, 4-hydroxy-3-(3-
		oxo-1-phenylbutyl)-, & salts, when present
		at concentrations greater than 0.3%
P028	100–44–7	Benzyl chloride
P015	7440–41–7	Beryllium powder
P017	598–31–2	Bromoacetone
P018	357–57–3	Brucine
P045	39196–18–4	2-Butanone, 3,3-dimethyl-1-(methylthio)-,
		O-[methylamino)carbonyl] oxime
P021	592–01–8	Calcium cyanide
P021	592–01–8	Calcium cyanide Ca(CN)2
P189	55285–14–8	Carbamic acid, [(dibutylamino)-
		thio]methyl-, 2,3-dihydro-2,2-dimethyl- 7-
		benzofuranyl ester.
P191	644–64–4	Carbamic acid, dimethyl-, 1-[(dimethyl-
		amino)carbonyl]- 5-methyl-1H- pyrazol-3-yl
		ester.
P192	119–38–0	Carbamic acid, dimethyl-, 3-methyl-1- (1-
		methylethyl)-1H- pyrazol-5-yl ester.
P190	1129–41–5	Carbamic acid, methyl-, 3-methylphenyl
		ester.
P127	1563–66–2	Carbofuran.
P022	75–15–0	Carbon disulfide
P095	75–44–5	Carbonic dichloride

P189	55285–14–8	Carbosulfan.
P023	107–20–0	Chloroacetaldehyde
P024	106–47–8	p-Chloroaniline
P026	5344–82–1	1-(o-Chlorophenyl)thiourea
P027	542–76–7	3-Chloropropionitrile
P029	544–92–3	Copper cyanide
P029	544–92–3	Copper cyanide Cu(CN)
P202	64–00–6	m-Cumenyl methylcarbamate.
P030	.....	Cyanides (soluble cyanide salts), not
		otherwise specified
P031	460–19–5	Cyanogen
P033	506–77–4	Cyanogen chloride
P033	506–77–4	Cyanogen chloride (CN)Cl
P034	131–89–5	2-Cyclohexyl-4,6-dinitrophenol
P016	542–88–1	Dichloromethyl ether
P036	696–28–6	Dichlorophenylarsine
P037	60–57–1	Dieldrin
P038	692–42–2	Diethylarsine
P041	311–45–5	Diethyl-p-nitrophenyl phosphate
P040	297–97–2	O,O-Diethyl O-pyrazinyl phosphorothioate
P043	55–91–4	Diisopropylfluorophosphate (DFP)
P004	309–00–2	1,4,5,8-Dimethanonaphthalene,
		1,2,3,4,10,10-hexa- chloro-1,4,4a,5,8,8a,-
		hexahydro-,
		(1alpha,4alpha,4abeta,5alpha,8alpha,8abeta)
P060	465–73–6	1,4,5,8-Dimethanonaphthalene,
		1,2,3,4,10,10-hexa- chloro-1,4,4a,5,8,8a-
		hexahydro-,
		(1alpha,4alpha,4abeta,5beta,8beta,8abeta)-
P037	60–57–1	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-,
		(1aalpha,2beta,2aalpha,3beta,6beta,
		6aalpha,7beta, 7aalpha)-

P051	172–20–8	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-,
		(1aalpha,2beta,2abeta,3alpha,6alpha,
		6abeta,7beta, 7aalpha)-, & metabolites
P044	60–51–5	Dimethoate
P046	122–09–8	alpha,alpha-Dimethylphenethylamine
P191	644–64–4	Dimetilan.
P047	1534–52–1	4,6-Dinitro-o-cresol, & salts
P048	51–28–5	2,4-Dinitrophenol
P020	88–85–7	Dinoseb
P085	152–16–9	Diphosphoramide, octamethyl-
P111	107–49–3	Diphosphoric acid, tetraethyl ester
P039	298–04–4	Disulfoton
P049	541–53–7	Dithiobiuret
P185	26419–73–8	1,3-Dithiolane-2-carboxaldehyde, 2,4-
		dimethyl-, O- [(methylamino)-
		carbonyl]oxime.
P050	115–29–7	Endosulfan
P088	145–73–3	Endothall
P051	72–20–8	Endrin
P051	72–20–8	Endrin, & metabolites
P042	51–43–4	Epinephrine
P031	460–19–5	Ethanedinitrile
P194	23135–22–0	Ethanimidothioc acid, 2-(dimethylamino)-
		N-[[(methylamino) carbonyl]oxy]-2-oxo-,
		methyl ester.
P066	16752–77–5	Ethanimidothioic acid,
		N-[[(methylamino)carbonyl]oxy]-, methyl
		ester
P101	107–12–0	Ethyl cyanide
P054	151–56–4	Ethyleneimine
P097	52–85–7	Famphur
P056	7782–41–4	Fluorine

P057	640–19–7	Fluoroacetamide
P058	23422–53–9	Formetanate hydrochloride.
P197	17702–57–7	Formparanate.
P065	628–86–4	Fulminic acid, mercury(2+) salt (R,T)
P059	76–44–8	Heptachlor
P062	757–58–4	Hexaethyl tetraphosphate
P116	79–19–6	Hydrazinecarbothioamide
P068	60–34–4	Hydrazine, methyl-
P063	74–90–8	Hydrocyanic acid
P063	74–90–8	Hydrogen cyanide
P096	7803–51–2	Hydrogen phosphide
P060	465–73–6	Isodrin
P192	119–38–0	Isolan.
P202	64–00–6	3-Isopropylphenyl N-methylcarbamate.
P007	2763–96–4	3(2H)-Isoxazolone, 5-(aminomethyl)-
P196	15339–36–3	Manganese, bis(dimethylcarbamodithioato-
		S,S¢)-,
P196	15339–36–3	Manganese dimethyldithiocarbamate.
P092	62–38–4	Mercury, (acetato-O)phenyl-
P065	628–86–4	Mercury fulminate (R,T)
P082	62–75–9	Methanamine, N-methyl-N-nitroso-
P064	624–83–9	Methane, isocyanato-
P016	542–88–1	Methane, oxybis[chloro-
P112	509–14–8	Methane, tetranitro- (R)
P118	75–70–7	Methanethiol, trichloro-
P198	23422–53–9	Methanimidamide, N,N-dimethyl-N¢-[3-
		[[(methylamino)-carbonyl]oxy]phenyl]-,
		monohydrochloride.
P197	17702–57–7	Methanimidamide, N,N-dimethyl-N¢-[2-
		methyl-4-
		[[(methylamino)carbonyl]oxy]phenyl]-
P050	115–29–7	6,9-Methano-2,4,3-benzodioxathiepin,
		6,7,8,9,10,10-hexachloro-
		1,5,5a,6,9,9a-hexahydro-, 3-oxide

P059	76–44–8	4,7-Methano-1H-indene, 1,4,5,6,7,8,8-
		heptachloro-3a, 4,7,7a-tetrahydro-
P199	2032–65–7	Methiocarb.
P066	16752–77–5	Methomyl
P068	60–34–4	Methyl hydrazine
P064	624–83–9	Methyl isocyanate
P069	75–86–5	2-Methyllactonitrile
P071	298–00–0	Methyl parathion
P190	1129–41–5	Metolcarb.
P128	315–8–4	Mexacarbate.
P072	86–88–4	alpha-Naphthylthiourea
P073	13463–39–3	Nickel carbonyl
P073	13463–39–3	Nickel carbonyl Ni(CO)4, (T-4)-
P074	557–19–7	Nickel cyanide
P074	557–19–7	Nickel cynaide Ni(CN)2
P075	1 54–11–5	Nicotine, & salts
P076	10102–43–9	Nitric oxide
P077	100–01–6	p-Nitroaniline
P078	10102–44–0	Nitrogen dioxide
P076	10102–43–9	Nitrogen oxide NO
P078	10102–44–0	Nitrogen oxide NO2
P081	55–63–0	Nitroglycerine (R)
P082	62–75–9	N-Nitrosodimethylamine
P084	4549–40–0	N-Nitrosomethylvinylamine
P085	152–16–9	Octamethylpyrophosphoramide
P087	20816–12–0	Osmium oxide OsO4, (T-4)-
P087	20816–12–0	Osmium tetroxide
P088	145–73–3	7-Oxabicyclo[2.2.1]heptane-2,3-
		dicarboxylic acid
P194	23135–22–0	Oxamyl.
P089	56–38–2	Parathion
P034	131–89–5	Phenol, 2-cyclohexyl-4,6-dinitro-
P048	51–28–5	Phenol, 2,4-dinitro-
P047	1 534–52–1	Phenol, 2-methyl-4,6-dinitro-, & salts

P020	88–85–7	Phenol, 2-(1-methylpropyl)-4,6-dinitro-
P009	131–74–8	Phenol, 2,4,6-trinitro-, ammonium salt (R)
P128	315–18–4	Phenol, 4-(dimethylamino)-3,5-dimethyl-,
		methylcarbamate (ester).
P199	2032–65–7	Phenol, (3,5-dimethyl-4-(methylthio)-,
		methylcarbamate
P202	64–00–6	Phenol, 3-(1-methylethyl)-, methyl
		carbamate.
P201	2631–37–0	Phenol, 3-methyl-5-(1-methylethyl)-, methyl
		carbamate.
P092	62–38–4	Phenylmercury acetate
P093	103–85–5	Phenylthiourea
P094	298–02–2	Phorate
P095	75–44–5	Phosgene
P096	7803–51–2	Phosphine
P041	311–45–5	Phosphoric acid, diethyl 4-nitrophenyl ester
P039	298–04–4	Phosphorodithioic acid, O,O-diethyl
		S-[2-(ethylthio)ethyl] ester
P094	298–02–2	Phosphorodithioic acid, O,O-diethyl
		S-[(ethylthio)methyl] ester
P044	60–51–5	Phosphorodithioic acid, O,O-dimethyl S-[2-
		(methylamino)-2-oxoethyl] ester
P043	55–91–4	Phosphorofluoridic acid, bis(1-methylethyl)
		ester
P089	56–38–2	Phosphorothioic acid, O,O-diethyl O-(4-
		nitrophenyl) ester
P040	297–97–2	Phosphorothioic acid, O,O-diethyl O-
		pyrazinyl ester
P097	52–85–7	Phosphorothioic acid,
		O-[4-[(dimethylamino)sulfonyl]phenyl]
		O,O-dimethyl ester
P071	298–00–0	Phosphorothioic acid, O,O,-dimethyl O-(4-
		nitrophenyl) ester
P204	57–47–6	Physostigmine.

P188	57–64–7	Physostigmine salicylate.
P110	78–00–2	Plumbane, tetraethyl-
P098	151–50–8	Potassium cyanide
P098	151–50–8	Potassium cyanide K(CN)
P099	506–61–6	Potassium silver cyanide
P201	2631–37–0	Promecarb
P070	116–06–3	Propanal, 2-methyl-2-(methylthio)-,
		O-[(methylamino)carbonyl]oxime
P203	1646–88–4	Propanal, 2-methyl-2-(methyl-sulfonyl)-, O-
		[(methylamino)carbonyl] oxime.
P101	107–12–0	Propanenitrile
P027	542–76–7	Propanenitrile, 3-chloro-
P069	75–86–5	Propanenitrile, 2-hydroxy-2-methyl-
P081	55–63–0	1,2,3-Propanetriol, trinitrate (R)
P017	598–31–2	2-Propanone, 1-bromo-
P102	107–19–7	Propargyl alcohol
P003	107–02–8	2-Propenal
P005	107–18–6	2-Propen-1-ol
P067	75–55–8	1,2-Propylenimine
P102	107–19–7	2-Propyn-1-ol
P008	504–24–5	4-Pyridinamine
P075	1 54–11–5	Pyridine, 3-(1-methyl-2-pyrrolidinyl)-, (S)-,
		& salts
P204	57–47–6	Pyrrolo[2,3-b]indol-5-ol, 1,2,3,3a,8,8a-
		hexahydro-1,3a,8-trimethyl-,
		methylcarbamate (ester), (3aS-cis)-.
P114	12039–52–0	Selenious acid, dithallium(1+) salt
P103	630–10–4	Selenourea
P104	506–64–9	Silver cyanide
P104	506–64–9	Silver cyanide Ag(CN)
P105	26628–22–8	Sodium azide
P106	143–33–9	Sodium cyanide
P106	143–33–9	Sodium cyanide Na(CN)
P108	1 57–24–9	Strychnidin-10-one, & salts

P018	357–57–3	Strychnidin-10-one, 2,3-dimethoxy-
P108	1 57–24–9	Strychnine, & salts
P115	7446–18–6	Sulfuric acid, dithallium(1+) salt
P109	3689–24–5	Tetraethyldithiopyrophosphate
P110	78–00–2	Tetraethyl lead
P111	107–49–3	Tetraethyl pyrophosphate
P112	509–14–8	Tetranitromethane (R)
P062	757–58–4	Tetraphosphoric acid, hexaethyl ester
P113	1314–32–5	Thallic oxide
P113	1314–32–5	Thallium oxide Tl2O3
P114	12039–52–0	Thallium(I) selenite
P115	7446–18–6	Thallium(I) sulfate
P109	3689–24–5	Thiodiphosphoric acid, tetraethyl ester
P045	39196–18–4	Thiofanox
P049	541–53–7	Thioimidodicarbonic diamide
		[(H2N)C(S)]2NH
P014	108–98–5	Thiophenol
P116	79–19–6	Thiosemicarbazide
P026	5344–82–1	Thiourea, (2-chlorophenyl)-
P072	86–88–4	Thiourea, 1-naphthalenyl-
P093	103–85–5	Thiourea, phenyl-
P185	26419–73–8	Tirpate.
P123	8001–35–2	Toxaphene
P118	75–70–7	Trichloromethanethiol
P119	7803–55–6	Vanadic acid, ammonium salt
P120	1314–62–1	Vanadium oxide V2O5
P120	1314–62–1	Vanadium pentoxide
P084	4549–40–0	Vinylamine, N-methyl-N-nitroso-
P001	1 81–81–2	Warfarin, & salts, when present at
		concentrations greater than 0.3%
P205	137–30–4	Zinc, bis(dimethylcarbamodithioato-S,S¢)-,
P121	557–21–1	Zinc cyanide
P121	557–21–1	Zinc cyanide Zn(CN)2
P122	1314–84–7	Zinc phosphide Zn3P2, when present at

		concentrations greater than 10% (R,T)
P205	137–30–4	Ziram.

Appendix F
Chemical Use Planning Form

Appendix G. HAZARD ASSESSMENT AND PERSONAL PROTECTIVE EQUIPMENT REQUIREMENTS FOR GENERAL LABORATORY OPERATIONS

Hazard	Personal Protective Equipment Required		
	Eye	Face	Hand/Skin/ Body
Any laboratory use of chemicals	Safety glasses at all times		Lab coat optional
Use of corrosive chemicals, strong oxidizing agents, carcinogens, mutagens, etc. In quantities of 4 liters or more	Safety glasses	Full face shield	Resistant gloves (See Appendix chemical resistance of common materials) Impervious lab coat, coveralls, a protective suit (for work with ov gallons corrosive liquids)
Temperature Extremes			Insulated gloves for handling ov furnaces, cryogenic bath and ot devices over 100 °C or below -1
Sharp objects (broken glass, insertion of tubes or rods into stoppers)	Safety glasses		Heavy cloth barrier or leather gl